State of the

Regional Water System

Hetch Hetchy Regional Water System

Services of the San Francisco Public Utilities Commission

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List of Abbreviations

AAR	Alternatives Analysis Report
AC	alternating current
ACAMS	alarm control and monitoring system
ACDD	Alameda Creek Diversion Dam
ac-ft	acre feet
AEP	Alameda East Portal
AF	acre-feet
AMI	Advanced Meter Infrastructure
ARV	air release valve
AS	Alameda Siphon
AVV	air vacuum valve
AWP	Alameda West Portal
AWWA	American Water Works Association
Baden	Baden Pump Station and Valve Lot
BDPL	Bay Division Pipeline
BFV	butterfly valve
BHR	Bioregional Habitat Restoration
BMP	best management practice
BO	blowoff valve
B&V	Black & Veatch
CAL FIRE	California Department of Forestry and Fire Protection
CALPL	Calaveras Pipeline
Cal Water	California Water Service Company
CCR	California Code of Regulations
CCSF	City and County of San Francisco
CCT	Chlorine Contact Tank
CDD	City Distribution Division
CDRP	Calaveras Dam Replacement Project
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CIP	Capital Improvement Program
CM	corrective maintenance
CML	cement-mortar-lined
CMMS	Computerized Maintenance Management System

CP	cathodic protection
CPM	Cathodic Protection Manual
CPUC	California Public Utilities Commission
CRT	Coast Range Tunnel
CSBT	Crystal Springs Bypass Tunnel
CSOS	Crystal Springs Outlet Structure
CSPL	Crystal Springs Pipeline
CSPS	Crystal Springs Pump Station
DBP	Disinfection Byproduct
DC	direct current
DDW	Division of Drinking Water
Districts	Turlock Irrigation District and Modesto Irrigation Districts
DMV	Department of Motor Vehicles
DOT	Department of Transportation
D/P	differential pressure
DSOD	Division of Safety of Dams
DWR	California Department of Water Resources
EAP	Emergency Action Plan
EBMUD	East Bay Municipal Utility District
FAACS	Fixed-Asset Accounting System
FEMA	Federal Emergency Management Agency
FM	Force Main
FY	fiscal year
GIS	geographic information system
gpm	gallons per minute
GSR	Regional Groundwater Storage and Recovery Project
HHWP	Hetch Hetchy Water and Power
HTWTP	Harry Tracy Water Treatment Plant
HVAC	heating, ventilation, and air conditioning
i-INFO	SFPUC's emergency notification software
ICS	Incident command system
IPS	Iron Pipe Straight threaded plug
IT	information technology
LCA	Lower Cherry Aqueduct
LCR	lead and copper rule
LCSD	Lower Crystal Springs Dam

LCSR	Lower Crystal Springs Reservoir
LMPS	Lake Merced Pump Station
LOS	level of service
LOTO	lockout-tagout
MAXIMO	Specific CMMS software used by SFPUC (Oracle product)
MCL	maximum contaminant level
MG	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
MW	megawatt
N/A	not applicable
NAVD88	North American Vertical Datum of 1988
NCSBPL	New Crystal Springs Bypass Pipeline
NCSBT	New Crystal Springs Bypass Tunnel
NIPP	National Infrastructure Protection Plan
NIT	New Irvington Tunnel
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRLMD	Natural Resources and Lands Management Division
NTU	Nephelometric Turbidity Unit
O&M	operations and maintenance
OSHA	Occupational Safety and Health Administration
PAC	powdered activated carbon
PAPL	Palo Alto Pipeline
PCCP	prestressed concrete cylinder pipe
PG&E	Pacific Gas and Electric Company
PIL	Pilarcitos Dam
PLC	programmable logic controller
PM	preventive maintenance
PPE	personal protective equipment
PPSU	Peninsula Pipelines Seismic Upgrade
PRV	pressure-relief valve
Pulgas PS	Pulgas Pump Station
PVC	polyvinyl chloride
R&R	rehabilitation and replacement
RCP	reinforced concrete cylinder pipe

RMU	remote monitoring unit
ROV	remote-operated vehicle
ROW	right-of-way
RWS	Hetch Hetchy Regional Water System
SABPL	San Antonio Backup Pipeline
SAPL	San Andreas Pipeline
SAPS	San Antonio Pump Station
SCADA	Supervisory Control and Data Acquisition
SCVWD	Santa Clara Valley Water District
SFPUC	San Francisco Public Utilities Commission
SFWD	San Francisco Water Department
SJCA	San Joaquin Valley Pipelines Condition Assessment
SJPL	San Joaquin Pipeline
SOP	standard operating procedures
sq. mi	square miles
SSBPL	Sunset Branch Pipeline
SSPL	Sunset Supply Pipeline
TOSPL	Town of Sunol Pipeline
SVCF	Sunol Valley Chloramination Facility
SVWTP	Sunol Valley Water Treatment Plant
SWRCB	State Water Resources Control Board
TBD	to be determined
T&O	taste and odor
TOC	total organic carbon
TTF	Tesla Treatment Facility
TWR	Treated Water Reservoir
UCSR	Upper Crystal Springs Reservoir
UPS	Uninterruptible Power Supply
U.S. EPA	United States Environmental Protection Agency
USFS	United States Forest Service
UV	ultraviolet
VMS	video management system
VSAT	very small aperture terminal
WECC	Western Electricity Coordinating Council
WEIP	Watershed and Environmental Improvement Program
WQD	Water Quality Division

WSA	Water Supply Agreement
WSIP	Water System Improvement Program
WSP	welded steel pipe
WSTD	Water Supply and Treatment Division

1. Overview

1.1 Purpose of this Report

This 2018 update of the State of the Hetch Hetchy Regional Water System (RWS) report conveys the state of the assets comprising the RWS. For this report, the term "asset" is used to describe facilities, linear assets (e.g. pipeline, tunnels), dams, watershed and right-of-way (ROW) assets (e.g. road), and communication system assets. Often, in the industry, an "asset" is defined as a specific component of a system or facility, such as a pump, a turbine, or a segment of pipeline. A "facility" is defined as a system of assets that operate together to perform a function, such as a pump station, powerhouse, or entire pipeline. This report provides asset inventories and information regarding the condition, recent performance, project status, and notable milestones of the RWS. The report is made available to customers and stakeholders and is frequently used internally for reference purposes and budget preparation.

This report is also used to satisfy a contractual requirement of the July 2009 Water Supply Agreement between the San Francisco Public Utilities Commission (SFPUC) and its wholesale water customers (Section 3.10B):

> *San Francisco will submit reports to its retail and wholesale customers on the "State of the Regional Water System," including reports on completed and planned maintenance, repair, or replacement projects or programs, by September of every even-numbered year, with reports to start in September 2010.*

Prior reports focused on the regions encompassed by the SFPUC's Water System Improvement Program (WSIP), excluding assets in San Francisco. Today, the report incorporates assets throughout the RWS into a common structure, bringing levels of detail and asset management processes to a common standard where possible. The 2018 report furthers this integration and includes new discussion on the emerging issue of increased industry focus on dam safety regulatory compliance.

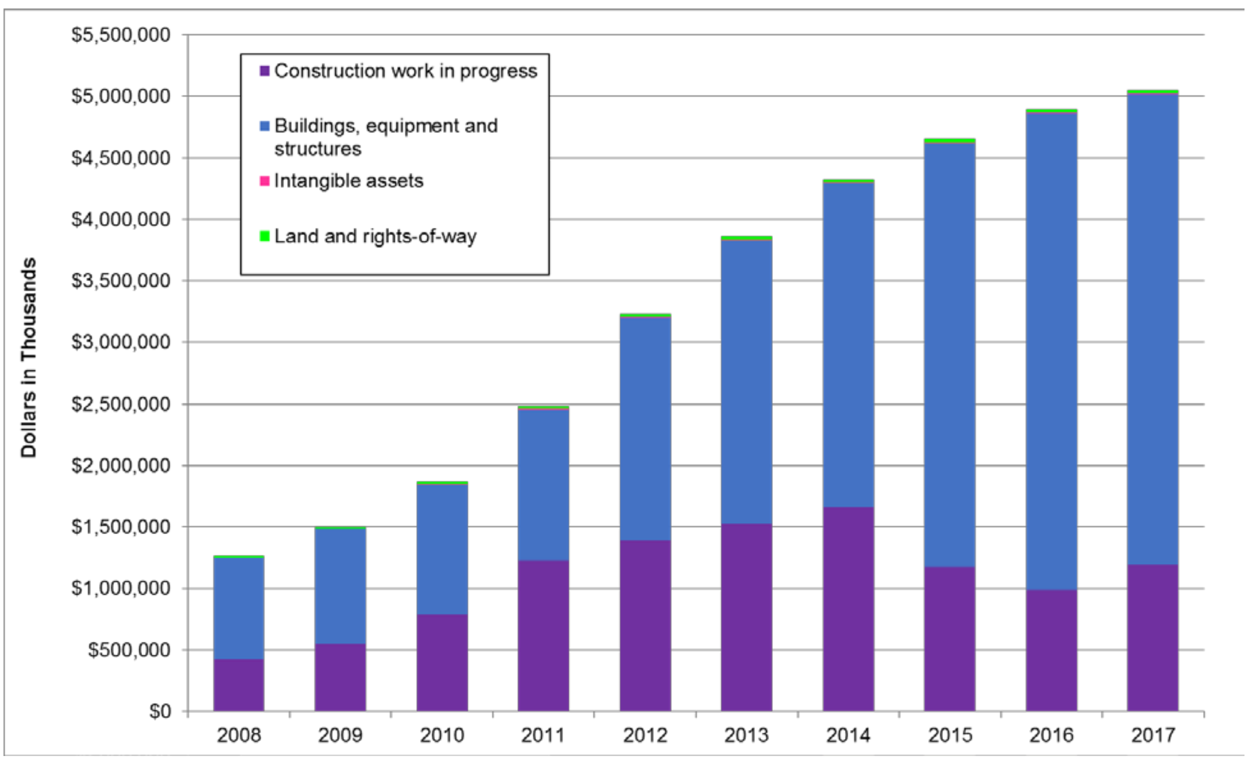
The Hetch Hetchy RWS is owned and operated by the SFPUC, a department of the City and County of San Francisco (CCSF), and serves both retail and wholesale customers in seven counties in the Bay Area. The SFPUC is responsible for the operations, maintenance, and development of three utility enterprises: Water, Wastewater, and Power. The Water Enterprise manages the RWS through two operating divisions that report to the Assistant General Manager of Water: Hetch Hetchy Water and Power (HHWP) and Water Supply and Treatment Division (WSTD). HHWP manages the upcountry portion of the RWS, which is anchored by Hetch Hetchy Reservoir; the reservoir stores water that is then transported through three tunnels and two hydroelectric powerhouses before entering the San Joaquin Pipelines (SJPLs), which in turn lead to the Tesla Treatment Facility (TTF) and the Coast Range Tunnel (CRT). The TTF is operated by WSTD. WSTD manages the Bay Area portion of the RWS, which includes water collection, transmission, and treatment facilities from the Alameda East Portal (AEP) at the end of the CRT, through the wholesale service area, to terminal reservoirs in San Francisco. Facilities include the watersheds and dams that form our Calaveras, San Antonio, Crystal

Springs, Pilarcitos, and San Andreas Reservoirs. The associated water treatment facilities are the TTF, which disinfects the Hetch Hetchy supply; the Sunol Valley Water Treatment Plant (SVWTP), which treats the Alameda Creek supply; and the Harry Tracy Water Treatment Plant (HTWTP), which treats the Crystal Springs Reservoir system supply. The water transmission system in the Bay Area includes the San Antonio Pipeline, the Bay Division Pipelines (BDPLs), the San Andreas Pipelines (SAPLs), the Sunset Supply Pipeline (SSPL), and the Crystal Springs Pipelines (CSPLs); and the Irvington, Bay, Crystal Springs Bypass, and Hillsborough Tunnels.

1.2 Value Added Under Water System Improvement Program

As of September 2018, the $4.8-billion WSIP is more than 95 percent complete, with the Calaveras Dam Replacement Project (CDRP) being the largest project still under construction. The program was initiated in 2002 to repair, replace, and seismically upgrade the system's pipelines, tunnels, water treatment facilities, reservoirs, pump stations, storage tanks, and dams to meet level of service (LOS) goals and objectives (see Section 3.1.1). Accordingly, investments in capital assets have increased considerably over the last 10 years. Consistent with the program's schedule, construction work declined in fiscal years (FYs) 2015 and 2016 for the first time after steadily increasing for the prior 10 years (Figure 1-1).

Figure 1-1: Water Investments in Capital Assets



The value of assets added to the RWS under the WSIP and other capital programs requires an appropriate asset management strategy (Section 3) and a sustainable budget to ensure the performance of new and existing infrastructure into the future.

In FY18, integration of new conjunctive-use groundwater wells into the RWS took substantial steps forward by completing drilling, construction, and initial testing of well stations associated with Phase 1 of the Regional Groundwater Storage and Recovery Project (GSR). These facilities will require significant operations and maintenance (O&M) efforts in FY19 and beyond as the new wells are commissioned and brought into the operation of the RWS. The goal of the project is to provide up to 7.2 million gallons per day (mgd) of dry-year water supply over 7.5 years. The original project design included the construction of as many as 16 groundwater well stations, to be connected to three wholesale customers on the Upper Peninsula and the RWS transmission system, to achieve the water supply goal. Phase 1 included the installation of 13 well stations, to produce approximately 6.2 mgd; the original scope of Phase 2 included construction of two to three additional well stations, based on well yield. Due to difficulties with siting well stations in the central portion of the groundwater basin, Phase 2 has been modified to install as many as three test wells (Ludeman North, Ludeman South, and Centennial Trail); complete the Antoinette Lane Well and pipeline; and complete other Phase 1 scope items, including treatment, chemical system monitoring, and sampling and storage at various sites. Operating the Phase 1 wells will allow the SFPUC to gain experience and insight into the pumping capacities of each individual well, and to better understand how the wells work in combination with each other and with existing municipal and irrigation wells. SFPUC staff will gain valuable experience regarding the relationship of GSR drought-year pumping to the management of the groundwater basin. Operational experience will allow refinement of the modeled dry year water supply yield of the GSR project.

No decision has yet been made regarding the conversion of the Phase 2 test wells to production wells. The Phase 2 test wells will enable the SFPUC to determine whether the identified sites could be viable future production wells; and will provide valuable information related to water quality and potential pumping capacities that can be used for future planning and decision making. Based on the extended pumping tests of the Phase 2 test wells to be implemented in late 2018 and early 2019, the SFPUC will provide an updated yield estimate for the GSR, and will provide schedule, cost estimates, and funding considerations. This information will be used to modify the GSR scope to make one or more of the test wells into permanent wells, if deemed appropriate to do so based on the updated yield estimates.

The Peninsula Pipelines Seismic Upgrade Project (PPSU) (Phase 3) began construction in early September 2016, and final construction was completed in the fall of 2017. Completion of this project marks the milestone achievement of the seismic LOS objectives established under the WSIP (see Section 3.1.1).

1.3 Continuing to Invest

The right size matters, especially for the Capital Improvement Program (CIP). As shown in Figure 1-1, investments are decreasing from the peak under the WSIP. Based on the size of the CIP now (about $1,660 million, including Hetch Hetchy water and joint assets), the SFPUC still expects to invest about $170 million per year for the next 10 years. The year-to-year value of the 10-year CIP is important to monitor to ensure that the right investments are made as assets age.

In practice, this rate of investment in capital projects necessitates an active planning function. Accordingly, during FY18, capital planning proceeded on SVWTP Ozone and Polymer Feed

Upgrades and CSPL No. 2 through Hillsborough. Prior planning efforts over the last 15 years have been consolidated and characterized to ensure that all potential scope not addressed under the WSIP or concurrent capital plans was reviewed and considered.

SFPUC staff were intensely busy in FY15 and FY16, completing drought-related projects that would help stretch water supplies. Although drought conditions relented in FY17 and FY18, projects intended to deal with drought conditions in the future, primarily those concerned with increasing and accessing the groundwater supply, have progressed as noted above.

Another dry-year project involved equipping wholesale customer service meters with cellular-based Advanced Meter Infrastructure (AMI) functionality. The AMI installations allow customers' staff to track usage in near real-time via a customer website known as Eye on Water. Usage data are updated daily. The SFPUC currently uses AMI-metered data for billing purposes. As of November 2017, all but two wholesale service meters have been converted; the remaining two are expected to be upgraded within the next 2 years. The AMI functionality helps customers, saves costs, and will greatly aid the administration of any water allocation restrictions should the SFPUC implement restrictions during future droughts.

The repair of Mountain Tunnel became a SFPUC priority in 2014. The SFPUC is currently active on three parallel tracks regarding Mountain Tunnel. These are: the Adits and Access Improvement Project; the Inspection and Repairs Project; and the Long-Term Improvements Project. A complete shutdown and draining of Mountain Tunnel was performed during January and February 2017 to accomplish the Inspection and Interim Repairs Project and the Adits and Access Improvement Project—and to develop information and knowledge for the design and construction of the Long-Term Improvements Project. Additional interim repairs will be performed in a planned January 2019 60-day shutdown to reduce the risk of failures in the concrete lining. The Mountain Tunnel Long-Term Improvement Project will include five additional shutdowns of 60 to 100 days, to occur in 2021 through 2026. These scheduled outages place higher stress on local supplies and operations.

1.4 Recent Notable Events

During the last 2 years spanning the reporting period, two incidents stand out. The first involved the failure of the seats of the hollow-jet valves and the existing butterfly valves in the valve house downstream of Cherry Valley Dam in 2017. Although the hollow-jet valves were scheduled for replacement with fixed-cone valves, the discovery of deficiencies in the butterfly valves required draining of the reservoir and modification to the replacement schedule. Through effective teamwork and collaboration between the project team and operations, the critical work was completed prior to the 2018 spring runoff season.

The second incident involved the March 22, 2018, storm event at Moccasin Reservoir. This extreme precipitation event resulted in very high flows in Moccasin Creek, carrying significant vegetation debris and sediment downstream. The flows overtopped the Moccasin Diversion Dam upstream of Moccasin Reservoir, carrying debris and sediment into the reservoir. The high flows resulted in a rapid rise of the reservoir level that peaked within 1.2 feet of the crest of the dam. The risk of dam overtopping, combined with the observation of seepage exiting the downstream face of the dam, necessitated an evacuation order downstream of the dam. As of the time of writing this report, cleanup of debris and sediment, repairs to the dam toe and auxiliary spillway, and subsurface investigation and overall condition assessment of the dam and appurtenant facilities are all ongoing. Interim repairs and improvements are planned for 2018, with the goal of placing the reservoir back into service in fall 2018; however, a larger capital project is anticipated, to address long-term needs to bring the dam and appurtenant facilities up to modern dam safety standards.

During the above events, the LOS were always met.

After a record drought, the winter of 2016/2017 was one of California's wettest winters on record and marked the end of the 5-year drought in most of the state, including the SFPUC watersheds and service area. On April 7, 2017, Governor Brown issued Executive Order B-40-17, lifting the drought emergency throughout the state; the SFPUC lifted its call for a voluntary 10 percent reduction in water use system-wide on April 11, 2017 (Resolution 17-0075). The SFPUC also notified its wholesale customers that it would no longer be requesting voluntary reductions. The RWS-wide storage has recovered.

The SFPUC will continue to move forward and be more proactive. For example, LOS objectives are maintained by continuously evaluating data gathered from maintenance and condition assessment reports, and proactively identifying areas of risk. Redundancy is built in where practical, and risks are mitigated where feasible. When redundancy and mitigation efforts are not possible, additional monitoring is put in place to track and trend changes in performance and/or the integrity of critical assets.

1.5 Emerging Issues

1.5.1 Dam Safety

The RWS includes 22 dams—including 17 regional dams outside San Francisco and five dams in San Francisco. Of these 22, only 15 are under the jurisdiction of the California Division of Safety of Dams (DSOD)—including 11 regional dams outside of San Francisco and four dams in San Francisco. The SFPUC's dam safety program includes annual visual inspections; monitoring of survey monuments, piezometers, slope inclinometers, and other instrumentation to monitor dam performance; periodic exercising of outlet works/valves; vegetation control; rodent control; and ongoing evaluation, maintenance, and repairs to dams and appurtenant facilities. In addition, the SFPUC owns, operates, and maintains several smaller dams that are not under the jurisdiction of the DSOD.

The Oroville Dam spillway incident that occurred in February 2017 has resulted in a renewed focus on dam safety in California as well as across the United States and worldwide. Following the Oroville incident, state legislation requires preparation or updates to Emergency Action Plans (EAPs) for dams under DSOD jurisdiction, and publication of maps that show the inundation area that would be flooded in the unlikely event that a dam (or an appurtenant feature of a dam such as an emergency spillway) breaks and releases water downstream of the dam in an uncontrolled manner. The SFPUC has updated its inundation maps and EAPs and submitted them to the DSOD and the California Office of Emergency Services in accordance with the legislation.

In addition, the Governor ordered the DSOD to identify spillways in the state associated with large high-hazard dams that could pose significant risk to the public if a spillway incident similar to Oroville were to occur. Accordingly, the DSOD identified approximately 100 such spillways throughout the state, and required comprehensive condition assessments to be conducted by the facility owners and submitted to the DSOD for review and appropriate action. The SFPUC received letters from the DSOD ordering the SFPUC to conduct condition assessments of the spillways for O'Shaughnessy Dam, Cherry Valley Dam, Turner Dam, and San Andreas Dam. These condition assessments are all underway, and results will be available between 2018 and 2020.

Additional state legislation requires the DSOD to update their inspection and reevaluation protocols by January 1, 2019. We anticipate that the updates to DSOD protocols may trigger additional actions that will require the SFPUC to perform updated stability analyses and/or potential failure mode analyses as a direct result of the updated protocols.

Nevertheless, the SFPUC has proactively addressed known dam safety concerns in recent years, through large capital projects implemented through both the WSIP and the 10-Year CIP. It is anticipated that additional capital projects will be needed to address potential dam safety issues revealed through the ongoing condition assessments and reevaluation of existing facilities in the coming years.

1.5.2 Water Quality

During FY17 and FY18, the SFPUC responded to several emerging water quality issues, including disinfection byproducts (DBPs) and taste and odor (T&O). Lead is another emerging water quality issue; it not included in this report, because it generally pertains to distribution systems.

Disinfection Byproducts

From March 2016 to July 2017, the Hetch Hetchy water supply experienced historically high levels of natural organic matter, normally measured as total organic carbon (TOC). These higher-than-normal TOC levels were likely related to several years of drought followed by near-record significant runoff. Similarly, a high-runoff event in April 2018 led to high TOC levels in the reservoir and the transmission system. On April 7, 2018, a warm storm melted snow, and Hetch Hetchy inflows reached 13,500 cubic feet per second (cfs). This flow rate was double the peak inflow rate during the rest of the 2018 snow runoff season. Peak inflows were quickly followed by an increase in turbidity, from 0.20 to 1.75 Nephelometric Turbidity Units (NTU) within 72 hours. TOC levels also increased from 1.41 milligrams per liter (mg/L) to 2.15 mg/L the week following the event. The inlets to the O'Shaughnessy Diversion are on two independent structures in Hetch Hetchy Reservoir: the lower inlet near the bottom of the reservoir (elevation 3,508 feet) and upper inlet halfway up from the bottom of the reservoir (3,624 feet). Each inlet is controlled by three gates (a total of six gates). Both inlets are traditionally left open, resulting in evenly distributed draft from both elevations. In response to the elevated turbidity from the storm, one gate was closed, so that three gates were open at elevation 3,624 feet, and two gates were open at elevation 3,508 feet. This action effectively increased the diversion from the higher elevation in Hetch Hetchy Reservoir and resulted in decreased turbidity from 1.75 to 1.20 NTU). It appears that the action improved water quality.

Operations was hesitant to close another lower valve due to loss of flow volume redundancy, and the age and condition of the valves involved.

In both events, elevated organic concentrations led to high DBP concentrations in the Hetch Hetchy supply. TOC or naturally occurring organic matter serves as a precursor to DBPs, which are formed with the addition of a water disinfectant like chlorine. To address this issue, the SFPUC took several actions, including increasing DBP monitoring; instituting wholesale customer notification when DBP levels reached 80 percent of drinking water standards (maximum contaminant levels [MCLs]); and ceasing prechlorination at the SVWTP in December 2016. Ceasing prechlorination at SVWTP significantly lowered DBPs at SVWTP, allowing the SFPUC to blend SVWTP water with Hetch Hetchy water and minimize the DBP levels in water served to customers. Other mitigation measures to reduce DBPs and understand their formation included the optimization of pH and chlorine dosing at Tesla Portal (June 2016), sending the Hetch Hetchy Supply to SVWTP for treatment (May 2017), and special DBP precursor monitoring of Hetch Hetchy Reservoir and Hetch Hetchy tributaries between April 2017 and August 2017.

Planned treatment improvements for the SVWTP that will also mitigate future DBP episodes include powdered activated carbon (PAC) and ozonation.

Taste and Odor

In early December 2016, the SFPUC received an unusually high number of T&O complaints by both retail and wholesale customers. The complaints were linked to an algal bloom in San Antonio Reservoir that was producing geosmin, a very common T&O compound. For a short-term correction, the SFPUC switched source waters to stop the T&O problem. For long-term improvements, the SFPUC increased the routine T&O compound monitoring program for East Bay Reservoirs (San Antonio and Calaveras) and initiated two treatment improvement projects for SVWTP: a PAC system and an ozone system. The PAC project was designed in 2017, and a construction contract was awarded in early 2018. Construction of the PAC treatment system is scheduled for completion in late 2018. An ozone treatment alternative analysis report was completed in early 2018. Conceptual engineering for the preferred alternative began in mid-2018. Although PAC will provide near-term treatment improvements at SVWTP, ozone will provide additional treatment capabilities for removing T&O compounds and will provide other water-quality benefits, such as DBP control. Ozone treatment will be a valuable tool for optimizing water quality from the SVWTP during long Hetch Hetchy shutdowns. Water Enterprise is also updating its Algae Monitoring and Mitigation Plan.

1.5.3 Wildfire

The SFPUC owns and manages approximately 94 square miles of watershed lands in Alameda, Santa Clara (Alameda Watershed), and San Mateo Counties (Peninsula Watershed)—almost twice the size of the City and County of San Fracisco boundaries. The SFPUC also maintains approximately 210 miles of ROW in the Bay Area. These watershed and ROW lands are managed in part to minimize risk of catastrophic wildfire, and over the last few years events have made this increasingly challenging. Similar to many areas of California, the SFPUC watershed lands have been affected by extended drought conditions and plant pathogens, in particular sudden oak death on the Peninsula Watershed. In response to the North Bay fires in

October 2017, the California Public Utilities Commission (CPUC) issued a decision adopting new regulations to enhance fire safety of overhead electrical power lines and communication lines in high fire-threat areas of the state. These new regulations affect how Pacific Gas and Electric Company (PG&E) and others manage utilities in SFPUC watersheds. Although the SFPUC is not regulated by the CPUC, these new regulations are considered the industry standard for the maintenance of SFPUC power lines in the watersheds. Collectively, this results in the SFPUC placing a higher priority on annual vegetation management compared to previous year on the watershed and ROW lands. The Alameda and Peninsula Watersheds are both State Responsibility Areas, which means that the California Department of Forestry and Fire Protection (CAL FIRE) leads response to wildfires in the watersheds, and that the SFPUC continues to work very closely with CAL FIRE staff on annual efforts to reduce fire hazard risk. This issue continues to evolve, and Senate Bill 901 was signed on September 21, 2018. As a result, the Water Enterprise staff are planning to update watershed and ROW fire management plans. Water Enterprise staff are also consulting with other large open space land managers in the Bay Area to glean insights from their experiences and apply this information to our planning efforts.

1.6 Organization of this Report

After this overview, the State of the RWS report provides a summary of the general operation and an inventory of the RWS assets in Section 2; an overview of the asset management program in Section 3; documentation of FY17-18 major accomplishments in maintenance and rehabilitation and replacement (R&R) projects as well as upcoming projects in Section 4; and finally a presentation of capital projects in the 10-year CIP for FY19-28 in Section 5.

2. Description of System Assets

This section summarizes the general operation of the RWS, and presents an inventory of the assets comprising the RWS. Section 2.1 describes the major components of the RWS and their interconnectivity. Section 2.2 provides a brief overview of the facilities contained in each of the major functional categories. These categories are the same as in the CIP.

2.1 General Description of Regional Water System

The Hetch Hetchy RWS, owned and operated by the SFPUC, is a complex series of reservoirs, tunnels, pipelines, pump stations, and treatment plants, delivering water from the Sierra Nevada and Bay Area watersheds to seven counties in the Bay Area. The RWS comprises two water systems, developed independently but operated as one. The first includes the local water system originally developed by the Spring Valley Water Company and purchased by the City of San Francisco in 1930. The Hetch Hetchy Water System, importing water from the Tuolumne River, is the second; it was built by the City of San Francisco and brought on line in 1934.

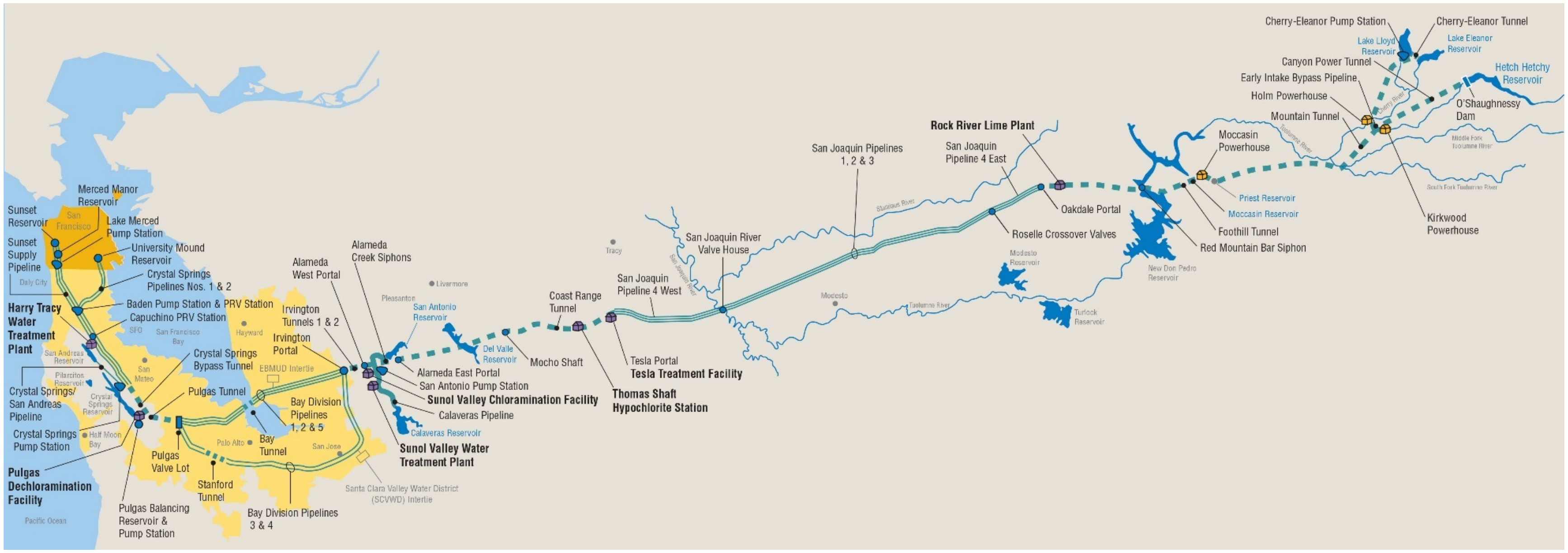
The RWS provides primary water supply for about 2.7 million residential, commercial, and industrial customers in San Francisco, Santa Clara, Alameda, San Mateo, and Tuolumne Counties. On average, 15 percent of the water delivered to SFPUC customers is derived from runoff in the Alameda and Peninsula watersheds. The remaining 85 percent comes from Sierra Nevada snowmelt and precipitation via the Tuolumne River and related facilities.

Once completed, groundwater wells in northern San Mateo County will produce about 6.2 mgd of dry-year supply as part of a SFPUC conjunctive-use project with the cities of Daly City and San Bruno, and the California Water Service Company (Cal Water). Another 4 mgd of groundwater will be produced from wells for retail delivery in San Francisco, starting with an average of 1 mgd in 2018.

A schematic of the RWS is shown on Figure 2-1. The RWS comprises facilities from the dams in the Sierra Nevada to terminal reservoirs in San Francisco. O'Shaughnessy Dam impounds water along the main stem of the Tuolumne River, thereby creating Hetch Hetchy Reservoir. The watershed for Hetch Hetchy Reservoir is 459 square miles in area and is entirely within Yosemite National Park. The Hetch Hetchy watershed is almost completely a federally designated wilderness area, and much of the watershed is only accessible by permit. Water collected in Hetch Hetchy Reservoir is intended for municipal use. Water can flow by gravity all the way from Hetch Hetchy Reservoir to downtown San Francisco.

The SFPUC's other two impounding reservoirs in the Tuolumne River basin, Lake Eleanor and Lake Lloyd (a.k.a. Cherry Lake), are used primarily to satisfy downstream flow obligations to the Turlock Irrigation District and the Modesto Irrigation District (the Districts), to maintain minimum instream flow releases below the reservoirs, to produce hydroelectric power at Holm Powerhouse, and to provide flows for recreational use (i.e., whitewater rafting).

Figure 2-1: Schematic of the Hetch Hetchy Regional Water System



Although Lake Eleanor and Lake Lloyd do not normally supply water directly to the Bay Area, water stored in these reservoirs is instrumental in preserving water in Hetch Hetchy Reservoir. Release of water from these reservoirs can partially fulfill CCSF's inflow obligations to the Districts, thereby allowing flow to be captured and retained in Hetch Hetchy Reservoir for diversion to the Bay Area.

Lake Eleanor is approximately 3 miles above the confluence of Eleanor and Cherry Creeks. Lake Lloyd is situated on Cherry Creek, about 4 miles above the confluence with Eleanor Creek. Lake Eleanor and Lake Lloyd are linked by a tunnel and pump facilities that allow water to flow from Lake Eleanor to Lake Lloyd. As a result of this linkage, the two reservoirs are generally operated as a single unit.

Water that is not released to the river below Lake Eleanor and Lake Lloyd is diverted through Cherry Power Tunnel to Holm Powerhouse. Holm Powerhouse is situated on Cherry Creek, about 1 mile upstream of its confluence with the Tuolumne River. Up to 1,010 cfs can be diverted through Holm Powerhouse and released into Cherry Creek, which quickly combines with the Tuolumne River. These releases also support CCSF's inflow obligations to the Districts.

In drought conditions and with prior approval from the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW), water from Lake Lloyd and Lake Eleanor can be diverted by Lower Cherry Diversion Dam to the Early Intake Diversion Structure on the Tuolumne River, where it would enter Mountain Tunnel to provide an alternative water source for consumption by RWS customers. When supplies from Lake Lloyd and Lake Eleanor are used, all diversions from the Tuolumne River must be filtered.

Water from Hetch Hetchy Reservoir is conveyed through the Canyon Power Tunnel to Kirkwood Powerhouse, where it can be used to generate power. Water from Kirkwood Powerhouse is discharged into Mountain Tunnel via the Early Intake Bypass Tunnel and Pipeline. Deliveries to Groveland Community Services District in Tuolumne County are made from waters pumped from Mountain Tunnel. Mountain Tunnel then conveys the Hetch Hetchy water to Priest Reservoir, after which it passes through Moccasin Powerhouse, again generating power. Water from Moccasin Powerhouse is discharged directly to Moccasin Reservoir. The state-operated Moccasin Fish Hatchery diverts up to 30 cfs from Moccasin Reservoir. From Moccasin Reservoir, Hetch Hetchy water travels via Foothill Tunnel to the Oakdale Portal. The Rock River Lime Plant injects hydrated lime at the Rock River shaft of Foothill Tunnel for corrosion control of the pipelines.

Local runoff that would normally flow into Priest and Moccasin Reservoirs is diverted around the reservoirs and discharged to Don Pedro Reservoir. Therefore, the water stored in Priest and Moccasin Reservoirs is primarily water from Hetch Hetchy Reservoir.

Large amounts of precipitation in the Moccasin Creek drainage area can result in an increase in Moccasin Creek elevation, to the point of overtopping the upstream control point of the Moccasin Reservoir where it then mixes with water from Hetch Hetchy Reservoir. To ensure uninterrupted delivery of clean Hetch Hetchy water, there are bypasses at both Priest and Moccasin Reservoirs that are used when needed to prevent unapproved water sources from entering the Foothill Tunnel and continuing through the RWS conveyance system.

The water supply enters Foothill Tunnel via the Moccasin Reservoir Bypass or the Moccasin Gate Tower. The water is treated at the Rock River Lime Plant, along the Foothill Tunnel, to adjust the pH of the water supply by injecting slaked lime (calcium hydroxide). The Foothill Tunnel terminates at Oakdale Portal, where the SJPLs begin.

As part of the WSIP, five new facilities were added in the San Joaquin Valley: two sections of SJPL (SJPL No. 4 East and SJPL No. 4 West), two crossover facilities (Emery and Pelican), and the TTF. Additional description of these new assets and capability is provided in this section. Numerous SJPL flow rate combinations are available by using the crossover valves and/or the throttling stations. At the San Joaquin River Valve House, pressure-reducing valves provide pressure relief for the system and a means of drainage at the low point of the pipeline. The SJPLs terminate at the new Tesla Valve House, where the water is treated at the TTF. At the TTF, water is exposed to ultraviolet (UV) light, pH is adjusted, fluoride is added, and primary disinfection begins with the addition of chlorine.

The water then enters the CRT, a 26-mile tunnel terminating at AEP in the Sunol Valley in Alameda County. There is a backup disinfection station at Thomas Shaft, approximately 4.5 miles downstream of Tesla Portal. Raw water entering the CRT is considered appropriately disinfected upon reaching AEP. AEP is considered a point of entry for drinking water permit purposes.

At AEP, water from the Tuolumne River is split among the four Alameda Siphons that cross the Calaveras Fault and Alameda Creek. The water then flows to the Sunol Valley Chloramination Facility (SVCF), where, under normal operating conditions, ammonia is added in the mixing chamber to form chloramines. Water then continues to the Alameda West Portal (AWP), where it enters the 3.5-mile-long Irvington Tunnels (Nos. 1 and 2). Tuolumne River water can also be diverted to San Antonio Reservoir or the SVWTP. The Calaveras and San Antonio Reservoirs collect local runoff from their surrounding watersheds to supplement Tuolumne River water. All local reservoir water in the East Bay is conveyed to SVWTP, where it is treated prior to entering the Alameda Siphons.

From the Irvington Tunnels, the blend of Tuolumne River water and water treated at SVWTP is split into the five BDPLs at the Irvington Portal in Fremont. BDPL Nos. 1, 2, and 5 continue west from the Irvington Tunnels, entering the new Bay Tunnel under San Francisco Bay from Newark to the Ravenswood area, then reentering BDPL Nos. 1, 2, and 5 to the Pulgas Tunnel west of Redwood City. The Bay Tunnel was commissioned in 2014 and replaced two existing underwater pipelines. BDPL Nos. 3 and 4 travel south from the Irvington Portal and follow the southern shore of San Francisco Bay through Santa Clara, Sunnyvale, Mountain View, Stanford Tunnel, and Palo Alto to the Pulgas Tunnel just west of Redwood City, where all five pipelines meet. Water in the Pulgas Tunnel may be diverted into the Crystal Springs Bypass Tunnel when needed to meet demands on the Peninsula; when no demand exists, water continues to the Pulgas Temple and flows into Upper Crystal Springs Reservoir (UCSR) after being dechloraminated at the Pulgas Dechloramination Facility. The Palo Alto Pipeline is supplied by BDPL Nos. 1, 2, and 5, and supplies water south from Redwood City to Palo Alto, Stanford, and Menlo Park.

North of the Crystal Springs bypass facilities, Hetch Hetchy/SVWTP water is transmitted north along the Peninsula into CCSF's low-pressure zone system via the SSPL and CSPL Nos. 1, 2, and 3. The terminal storage for low-pressure zone water consists of the University Mound Reservoir in San Francisco, which is supplied from CSPL Nos. 1 and 2. The SSPL low-pressure zone water is transmitted north along the Peninsula to the Lake Merced Pump Station (LMPS) in San Francisco, where it is pumped into the high-pressure zone. Water from the LMPS either serves demands directly or is stored in Sunset Reservoir and Sutro Reservoir in San Francisco.

The San Mateo Creek watershed on the peninsula supplies Lower Crystal Springs Reservoir (LCSR) and UCSR. Pilarcitos Creek watershed supplies are also used to supply LCSR. The Upper San Mateo Creek watershed supplies San Andreas Reservoir with a small amount, supplemented by the Pilarcitos watershed via the San Mateo pipeline. Water from LCSR is transferred to the San Andreas Reservoir through the Crystal Springs Pumps Station and CSPL-SAPL. HTWTP draws from San Andreas Reservoir for supply and produces high-pressure zone water. Treated water from HTWTP is transmitted through SAPL Nos. 2 and 3 and the Sunset Branch Pipeline. SAPL Nos. 2 and 3 reach high-pressure zone reservoirs in San Francisco. The Sunset Branch Pipeline connects high-pressure zone to low-pressure zone water in the SSPL through a pressure-reducing valve at the Capuchino Valve Lot in Millbrae. In Colma, at the San Pedro Valve Lot, SAPL No. 3 is interconnected with SSPL; north of this point, it is used for low-pressure zone water transmission to Merced Manor Reservoir. (This replaces the function previously provided by the abandoned Baden-Merced Pipeline.) Baden Pump Station allows low-pressure zone water from CSPL No. 2 to be pumped to each of the high-pressure zone pipelines. Baden Pump Station can also be used to transfer high-pressure zone water into the low-pressure zone pipelines. These inter-zone connections accomplished through the WSIP at San Pedro Valve Lot, Baden Pump Station, and Cappuchino greatly increase operational flexibility, particularly during construction work and emergencies.

The Pilarcitos watershed and reservoir to the west of San Andreas Reservoir is used to partially supply the Coastside County Water District, and also to supply the RWS via inter-basin transfers.

A major upgrade of the RWS facilities began in 2002,[1] with the initiation of the WSIP. Most of the projects are completed, and the program is 95 percent complete. As of September 2018, four regional projects (and four WSIP closeout projects) remain to be completed, the largest being the CDRP. The WSIP has significantly increased the reliability of the water system, and is discussed in detail elsewhere in this report.

2.1.1 Raker Act and Water Bank

The SFPUC constructed, operates, and maintains the Hetch Hetchy RWS and power facilities pursuant to the Raker Act. The Raker Act grants the SFPUC perpetual ROWs on federal lands for O'Shaughnessy Dam and related facilities, subject to certain terms and conditions. Pursuant to the Raker Act and state water law, the SFPUC operates the water and power facilities primarily for water supply, and secondarily for hydropower generation. The system is also

[1] The SFPUC approved the Long-Term Strategic Plan and the CIP in May 2002, followed by voter approval of revenue bond authority in November 2002. The first WSIP description (then referred to as the CIP) was submitted to the state in February 2003.

operated to meet minimum streamflow requirements under agreements with the Department of Interior, and to provide for whitewater rafting when water is available to do so.

The Raker Act requires the SFPUC to bypass certain flows to meet the senior water rights of the Districts downstream. The Raker Act also specifies sanitary regulations in the watershed, optimizes local supplies to minimize diversions from the Tuolumne River, and prohibits the sale of HHWP to private entities for resale.

One of the agreements between the SFPUC and the Districts allocates storage space in Don Pedro Reservoir as a "Water Bank Account" for the SFPUC. The SFPUC cannot and does not directly divert water from Don Pedro Reservoir into the RWS; however, the Water Bank Account allows the SFPUC to balance the Districts' Raker Act entitlements with system operations. The Water Bank Account grows when the inflows to Don Pedro Reservoir are greater than the Districts' entitlements. Conversely, the SFPUC debits the Water Bank Account when it impounds water at its reservoirs that would otherwise be within the Raker Act entitlements of the Districts. The SFPUC has agreed not to construct means to physically remove water from Don Pedro Reservoir, and cannot, without the prior agreement of the Districts, have a negative balance in the water bank.

The Water Bank Account is limited by the maximum allocation of the Water Bank Account storage, which in turn depends on whether the Districts are required to maintain a flood control reservation in Don Pedro Reservoir. During the months October through March, the Districts must maintain a flood control reservation of no less than 340,000 acre-feet (AF), which limits the maximum storage of the reservoir to 1,690,000 AF. Whenever the actual storage in Don Pedro Reservoir is equal to or less than 1,690,000 AF, the maximum Water Bank Account storage is limited to 570,000 AF. From the beginning of April through September, when flood control restrictions do not apply at Don Pedro Reservoir—and when the Districts, at their sole discretion, allow overall storage in Don Pedro Reservoir to exceed 1,690,000 AF—the SFPUC has temporary use of up to 170,000 AF of additional storage. These increases in the maximum allocation of Water Bank Account storage are temporary and must be evacuated at the start of the flood control season; the SFPUC does not depend on these temporary seasonal increases for purposes of long-term water-supply planning.

2.1.2 Operational Organization

The HHWP Division is responsible for O&M of the water supply and conveyance system facilities from Hetch Hetchy Reservoir to AEP (with some exceptions, described below). Beginning at the TTF, the WSTD manages all treatment and delivery facilities downstream, including Thomas Shaft and day-to-day valve operations at AEP, extending west through the Bay Area components of the RWS up to San Francisco. In the Bay Area, the Natural Resources and Lands Management Division (NRLMD) oversees O&M of SFPUC-owned watershed and ROW lands, and is responsible for environmental regulatory compliance for O&M of the water supply system, watershed, and ROW lands. At HHWP, NRLMD is responsible for environmental regulatory compliance for O&M of the water supply system, watershed, and ROW lands. The HHWP Division is responsible for environmental regulatory compliance for non-water-supply system facilities (e.g., utilities for Moccasin Compound and remote sites and powerhouses). The Water Quality Division (WQD) provides laboratory services, compliance monitoring, process engineering, regulatory reporting, and technical support for both HHWP and WSTD in operation of the RWS.

2.2 Description of Facilities

This section outlines the seven general asset categories, and includes a brief description of the facilities in each category.

2.2.1 Water Supply and Storage Facilities

Dams and Reservoirs

A list of RWS dams is provided in Appendix A, Table A-1. Outlet piping, valves, and spillways are part of each dam for facility classification purposes. All dams in the RWS are regularly monitored and surveyed independent of capital work. The state of the regular dam inspection and monitoring program is outlined in Section 4.1.1. For jurisdictional dams (see Table 3-2), annual field inspections are conducted in conjunction with the DSOD.

Reservoirs are listed in Appendix A, Table A-3. Supply reservoir O&M activities include limnological monitoring, application of algaecide, maintenance to aeration (or oxygenation) systems, boating facilities, and outlet structures.

The SFPUC uses sodium percarbonate for algae management. Applications to date have been limited to Calaveras Reservoir, San Antonio Reservoir, and Moccasin Reservoir; if algae conditions warrant it, application on other SFPUC reservoirs covered by state permits would be considered.

The treated-water reservoirs listed in Appendix A, Table A-4, require regular water-quality and security monitoring, extensive Supervisory Control and Data Acquisition (SCADA) instrumentation maintenance, regular removal of sediment, and structural upgrades.

O'Shaugnessy Dam

The RWS begins in the Hetch Hetchy Valley of Yosemite National Park at the O'Shaugnessy Dam and the Hetch Hetchy Reservoir. O'Shaugnessy Dam is a 312-foot-high above-streambed (430 feet above the lowest point in the foundation) gravity arch dam that impounds 360,360 AF (capacity with drum gates activated) of water along the main stem of the Tuolomne River, creating the Hetch Hetchy Reservoir. The dam was originally built in 1923 and raised in 1938. The Hetch Hetchy Reservoir collects water from the surrounding 450 square miles of the Hetch Hetchy watershed for the purpose of providing potable water supply to the Bay Area.

Cherry Valley Dam

Cherry Valley Dam is a 330-foot-high earth and rock fill dam. Lake Lloyd, the reservoir impounded by Cherry Valley Dam, stores approximately 273,500 AF. The dam was built in 1955. Water from the Cherry-Eleanor system is used for downstream flow obligations and power generation at Holm Powerhouse. With treatment and prior DDW approval, water from Lake Lloyd can be used to provide additional water supply in drought or emergency conditions.

Eleanor Dam

Eleanor Dam is a 70-foot concrete buttressed arch dam. Lake Eleanor stores approximately 27,113 AF (capacity with flashboards). The dam was built in 1918. Water from the Cherry-Eleanor system is used for downstream flow obligations and power generation at Holm Powerhouse. With treatment and prior DDW approval, water from the Lake Eleanor can be used to provide additional water supply in drought or emergency conditions.

Early Intake Dam

Early Intake Dam is an 81-foot-high concrete arch dam that impounds a storage volume of about 115 AF. The dam was built in 1924. Located on the mainstem of the Tuolumne River just downstream of Kirkwood Powerhouse, the dam provides the flexibility to divert water from the Tuolumne River or diversions from the Lower Cherry Aqueduct (LCA) into Mountain Tunnel. With treatment and prior DDW approval, water diverted at this dam into the RWS can be used to provide additional water supply in drought or emergency conditions.

Priest Dam

Priest Dam is a 160-foot-high earth and rock dam that impounds a storage volume 1,706 AF. The dam was built in 1923. Priest Reservoir stores Hetch Hetchy water before it reaches the Moccasin Powerhouse via the Moccasin Power Tunnel. Priest Reservoir has a pipeline bypass that can be used when local reservoir turbidities are high, typically during and following storm events.

Moccasin Dam

Moccasin Dam is a 70-foot-high earth and rock dam that impounds a storage volume of 552 AF. The dam was built in 1929. After leaving the Moccasin Powerhouse, the water is stored at the Moccasin Reservoir to provide a constant flow rate in the Foothill Tunnel. Moccasin Reservoir has a pipeline bypass that can be used when local reservoir turbidities are high or when performing maintenance at Moccasin Reservoir.

Calaveras Dam

Construction of Calaveras Dam by the Spring Valley Water Company began in 1913. The 220-foot-high earth and rock fill dam was finally completed in 1925 after the upstream face of the nearly completed dam had failed and slid into the reservoir in 1918. Since 2002, Calaveras Dam has been lowered to 40 percent of design capacity (to an elevation of 705 feet), due to seismic safety concerns and DSOD requirements. The SFPUC is currently replacing the dam with a new structure of earth and rock fill, a project known as the CDRP. The dam will provide equal storage capacity and improved seismic and hydrologic design, and is being constructed immediately downstream as part of the WSIP. The project is more than 90 percent complete, and the dam is embankment reached full height in summer 2018. Upon completion (expected in 2019), Calaveras Reservoir will return to being the system’s largest local reservoir and will represent more than half of the SFPUC storage capacity in the Bay Area, with a capacity of 96,800 AF (31.55 billion gallons). Water impoundment is expected to begin in fall 2018.

Outlet structure repairs to Crystal Springs, Calaveras, and San Andreas reservoirs were completed under the WSIP, including seismic upgrades.

Hypolimnetic oxygenation systems were installed in 2006 to improve water quality and support native fishes in the reservoirs.

Turner Dam (San Antonio Reservoir)

Turner Dam, built in the 1960s and completed in 1965, is the newest dam in the system. It is a 195-foot-high earth embankment dam. The dam is constructed on San Antonio Creek, a tributary of Alameda Creek, where it forms the San Antonio Reservoir.

San Antonio Reservoir is one of two SFPUC reservoirs in the East Bay and the third largest of the reservoirs in the Bay Area. Its capacity is 50,500 AF (16.4 billion gallons). The facility is in the relatively gentle hill country immediately northeast of Sunol Valley in the Alameda Creek watershed. Turner Dam and the reservoir are accessed from Indian Creek Road, which intersects Calaveras Road approximately 0.9 mile southeast of Interstate 680.

The reservoir is used to capture and store local runoff. It is also used to store water transferred from Hetch Hetchy Reservoir, the Calaveras Reservoir, the South Bay Aqueduct blow-off, or water recaptured from the emergency quarry pit storage facility at Surface Mining Permit (SMP) 24 Quarry Pit F3. All reservoir water must be treated at the SVWTP before being discharged into the transmission system. Water can also be discharged from the outlet structure into San Antonio Creek, immediately below the dam.

A hypolimnetic oxygenation system was installed in 2008 to improve water quality and support native fishes in the reservoirs.

Upper and Lower Crystal Springs Dams

Upper Crystal Springs Dam is a 92.5-foot-high non-DSOD jurisdictional earth embankment dam that separates UCSR and LCSR. Highway 92 is built on top of the structure. There is no isolation between the upper and lower reservoirs (as directed by the DSOD). The dam for UCSR is the roadbed supporting the Highway 92 crossing of the reservoirs. Originally, UCSR and LCSR were operated as separate reservoirs. In 1924, modifications were made to the UCSR dam so that unregulated flow is provided between the reservoirs, functionally making them act as one.

The dam for LCSR was designed by Hermann Schussler and includes an innovative system of large, interlocking concrete blocks. The 163-foot-high concrete gravity dam was constructed in 1890 and survived both the 1906 and 1989 earthquakes without significant damage. A WSIP project completed in 2011 lifted the DSOD-imposed restriction and restored the historical storage capacity of Crystal Springs Reservoir. The WSIP improvements enable floodwater associated with the probable maximum flood and other very large and infrequent floods to pass safely over the LCSR dam. The dam spillway was widened, its crest was reshaped and permanently raised, the parapet wall raised, and a new stilling basin was built at the toe of the dam to replace the existing stilling basin. In addition, outlet structure repairs were completed under the WSIP, including seismic upgrades.

UCSR impounds runoff from the local watershed and water from Hetch Hetchy that enters at Pulgas Temple. Before discharge into UCSR, the pH must be adjusted back to the regulatory level for the natural environment, and the chlorine and ammonia are removed.

LCSR is significantly larger and deeper than UCSR. It impounds local runoff, water transferred from Pilarcitos Creek, and the water flowing down from UCSR. The combined storage capacity is 69,300 AF.

San Andreas Dam

San Andreas Dam, a 105-foot-high earthen embankment dam built in 1870, impounds San Andreas Reservoir, with a maximum water surface elevation of 449 feet. The reservoir storage capacity is 19,000 AF. This reservoir is the raw water source for HTWTP. The water flowing into the reservoir includes local runoff, water diverted from Pilarcitos and San Mateo Creeks, and water pumped from LCSR through the Crystal Springs Pump Station (CSPS). The latter source provides the majority of the inflow. The San Andreas Fault runs along the eastern abutment of the reservoir. The reservoir is subject to periodic algal blooms that can limit the ability of the HTWTP (a direct filtration facility) to sustain its required maximum capacity of 140 mgd.

Emergency discharges were made through the original discharge pipeline, SAPL No. 1. The pipeline included turn-outs to creeks east of the reservoir. When SAPL No. 1 was decommissioned, two additional outlet structures were constructed—one for SAPL No. 2 and one for SAPL No. 3—and the emergency discharge function was transferred to the new pipelines. Since the time the initial emergency discharge strategy was established, the area surrounding the creek discharge locations has seen significant development, making the discharges more difficult.

Outlet structure repairs were completed under the WSIP, including seismic upgrades.

Pilarcitos Dam

Pilarcitos Dam is the oldest DSOD-regulated dam in the system. The 95-foot-high earthen embankment Pilarcitos Dam was constructed in 1866 and raised in 1874 to impound water from Pilarcitos Creek. The reservoir storage capacity is 3,100 AF. Approximately half of the Pilarcitos Reservoir supply goes to the Coastside County Water District to serve the Half Moon Bay area. Water can be transferred by gravity to LCSR. A hypolimnetic oxygenation system is being considered in conjunction with the other planned capital upgrades to the Pilarcitos system.

Stone Dam

Stone Dam is a non-DSOD jurisdictional 31-foot-high masonry arch dam. Releases below Stone Dam have been made since October 2006 to support native wildlife, including steelhead, downstream in Pilarcitos Creek.

Pulgas Balancing Reservoir

The Pulgas Balancing Reservoir is discussed with Pulgas Pump Station in the section on pump stations.

Sunset Reservoirs

The Sunset Reservoirs are one of three groups of treated water terminal reservoirs in San Francisco. They receive water from the SAPL No. 2 and SSPL via the Lake Merced Pump. The two reservoirs, termed the North Basin and the South Basin, were constructed in 1938 and 1960, respectively. In approximately 2010, the North Basin underwent a general upgrade that included a seismic retrofit.

Sunset North Reservoir Dam is a 74-foot-high, concrete-faced, earthen structure with a storage capacity of 275 AF. Sunset North reservoir is equipped with a 12-inch-diameter valved drain line. The outlet tower at the southwestern side of the reservoir allows water to be drawn from three different outlet elevations. The reservoir spills through a 50- by 34-inch shared conduit with an invert elevation of 396.3 feet North American Vertical Datum of 1988 (NAVD88).

Sunset South Reservoir Dam is a 34-foot-high, concrete-faced, earthen structure with a storage capacity of 286 AF. Sunset South reservoir is equipped with a 16-inch-diameter valved drain line. The reservoir spills through a 50- by 44-inch shared conduit with an invert elevation of 396.3 feet NAVD88.

The Sunset Reservoirs were seismically upgraded under the WSIP. General rehabilitation to Sunset Reservoir included repair of deteriorated concrete, replacement of the reservoir liner, replacement of inlet piping, and installation of security fencing.

University Mound Reservoirs

The University Mound Reservoirs are treated water terminal reservoirs in San Francisco. These reservoirs receive water from CSPL Nos. 1 and 2. The two reservoirs, termed the North Basin and the South Basin, were constructed in 1885 and 1937, respectively. In approximately 2011, the North Basin underwent a general upgrade that included a seismic retrofit.

University Mound North Reservoir Dam is a 17-foot-high, concrete-faced, earthen structure with a storage capacity of 59.4 million gallons. University Mound South Reservoir Dam is a 61-foot-high, concrete-faced, earthen structure with a storage capacity of 81.5 million gallons. Each basin has separate inlet and outlet pipes equipped with locally operated valves (typically butterfly valves, gate valves, or sluice gates) for isolation and control. The valves are inside a fenced enclosure. The North Basin's 42-inch inlet pipe, at the southeastern corner of the reservoir, has two inline 36-inch butterfly valves into the reservoir. Its 48-inch outlet pipe, at the eastern side of the reservoir, has two parallel 36-inch butterfly isolation valves. The South Basin's 60-inch inlet and outlet pipes have 48-inch gate valves, both under the gate tower on the eastern side of the basin roof. Each reservoir basin is equipped with a drain valve that allows the basin to be emptied for maintenance; water is transported from these valves through a 12-inch drain pipe that terminates in the sewer system.

Merced Manor Reservoir

Merced Manor is one of three treated water terminal reservoir groups in San Francisco. It was constructed in 1936, and has an average water depth of 20.5 feet and a capacity of 9.5 million gallons. The reservoir is a concrete underground reservoir divided into two basins that can be isolated and operated independently. Each basin has separate inlet and outlet pipes equipped with locally operated valves (typically butterfly valves, sluice gates, or gate valves) for isolation and control. The reservoir inlet and outlet are housed inside a valve vault and valve house. Both the North Basin 30-inch inlet pipe and the South Basin 30-inch inlet pipe are on the eastern side of the basin, near the center of the reservoir; they pass through the valve vaults and extend into the basin. The 36-inch outlet pipe is centrally located between the two basins, on the western side, inside the valve tower. A spillway runs around the outside perimeter of each basin and terminates into a catch basin structure. No extensive capital work is planned for Merced Manor Reservoir following work completed as part of the 1998 Measures A and B bond-funded seismic upgrade project (although a minor liner repair project is planned for 2018).

Wells

Groundwater wells represent both the newest and oldest facilities in the RWS. Table A-2 in Appendix A includes an inventory list of groundwater wells. The Pleasanton Well Field was constructed by the Spring Valley Water Company, beginning in 1898. Water produced by the wells was conveyed to the Sunol Water Temple via a 30-inch pipeline completed in 1909. Water was then routed into the Sunol Aqueduct. Today, the well field consists of two functioning wells that serve the Castlewood system without connection to the RWS.

Meanwhile, on the Peninsula, the GSR project (part of the WSIP) will coordinate use of both groundwater and surface water to increase water supply reliability during dry years or during emergencies. The GSR Project is a conjunctive-use partnership with the SFPUC, the City of Daly City, the City of San Bruno, and Cal Water, collectively referred to as Partner Agencies. Project wells are in San Mateo County; they will be used in coordination with the Partner Agencies who purchase wholesale surface water from the SFPUC, and also independently operate groundwater production wells for their own use. The GSR Project includes an Operating Agreement among the Partner Agencies, which outlines in-lieu surface water deliveries and groundwater pumping goals to provide dry-year water supply. The GSR Project consists of Storage Years, when surface water is delivered to Partner Agencies in lieu of groundwater pumping; and Recovery Years, when stored groundwater is pumped by the SFPUC and Partner Agencies. The GSR Project has been in a Storage Years phase since May/June 2016. As of March 2018, more than 11,000 AF of groundwater has been stored in the southern portion of the Westside Basin. Thirteen wells are currently in construction to be developed into well pump stations, with treatment at eight well stations.

Figure 2-2 shows the locations of the 13 new well stations in the southern portion of the Westside Basin. Nine of the thirteen wells connect directly to the SFPUC's RWS, two wells connect directly to the City of Daly City's distribution system, and two wells connect directly to Cal Water's distribution system. The well pump stations will begin commissioning testing in summer/fall 2018. As many as three test wells are being constructed in the southern portion of the Westside Basin to determine whether conditions are adequate to convert the test wells into GSR groundwater production wells. Construction of three test wells commenced in March 2018.

Figure 2-2: Location of GSR Groundwater Wells

2.2.2 Water Transmission

Pipelines

Inventory and Condition

Pipelines of the RWS west of the AEP range greatly in terms of installation date, pipeline material, pipeline condition, and operational importance. The current inventory is shown in Table A-6 in Appendix A. A graphical summary of pipeline and tunnel installations by material and installation date is shown on Figure 2-3. A graphical representation of cumulative pipeline and tunnel inventory by material and installation date is shown on Figure 2-4.

Figure 2-3: Linear Feet of Pipelines and Tunnels by Material and Installation Decade

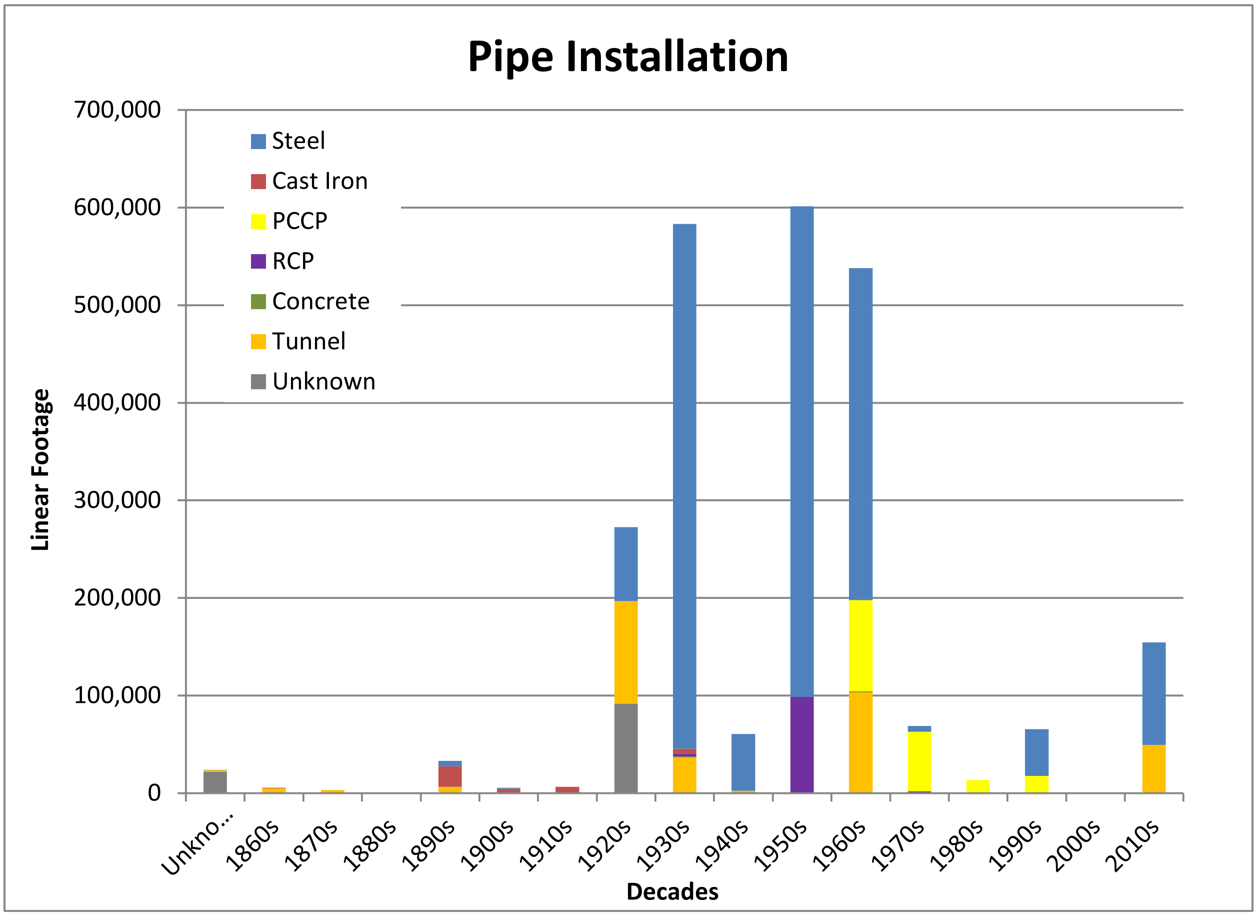
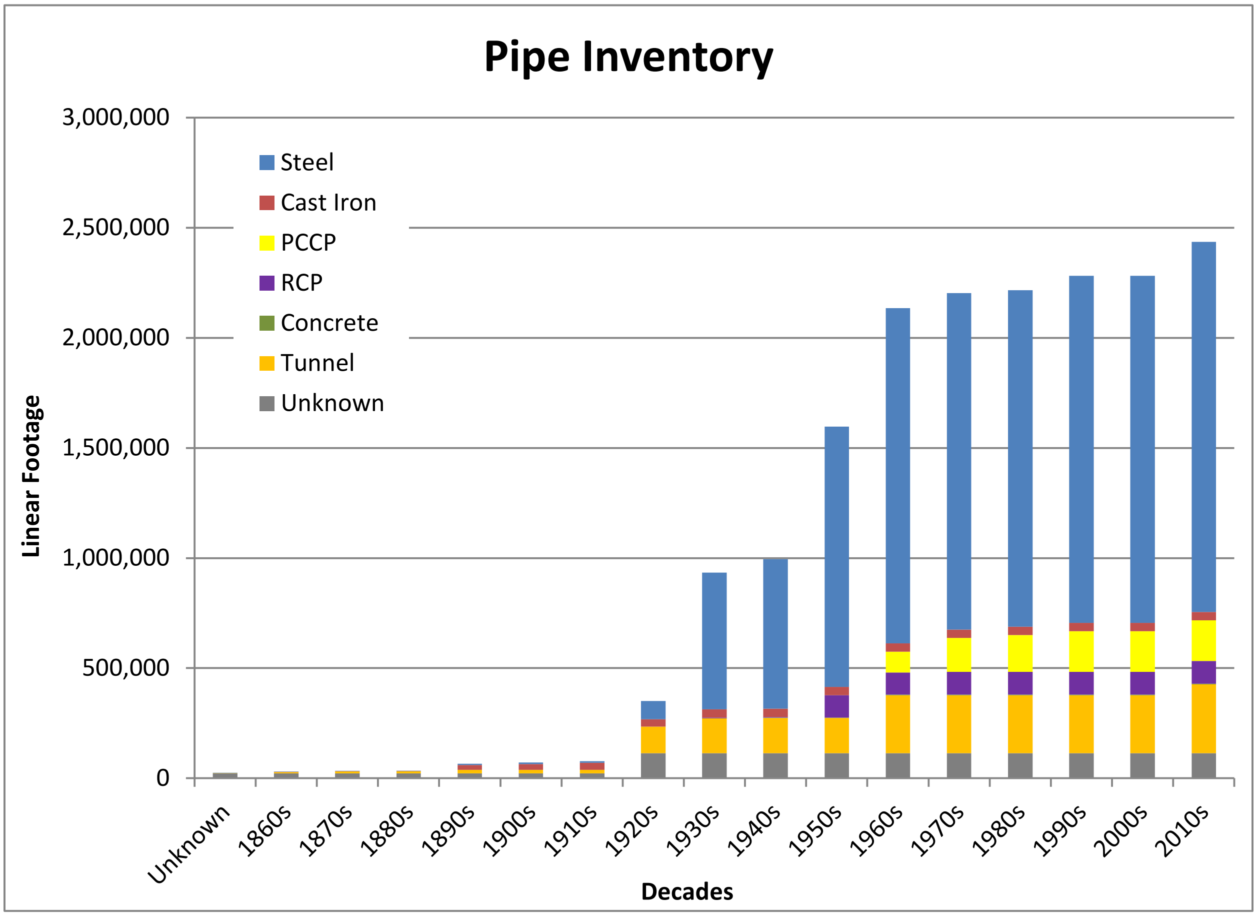


Figure 2-4: Cumulative Pipelines and Tunnels Inventory



Transmission projects completed by the Spring Valley Water Company between 1890 and 1930 were constructed using either cast iron or wrought steel. Cast-iron pipeline joints consisted of large swaged bell ends, into which a plain spigot end was inserted. Joints were sealed with leaded caulking material. The three submarine pipelines beneath Dumbarton Strait represented the last reaches of the RWS still using cast iron; they were decommissioned in the fall of 2014 after the Bay Tunnel was brought into service. Leaded content remains in the RWS only in limited brass appurtenances and meters that have trace amounts of lead, which will be phased out over time. Additionally, an approximately 800-foot-long, leaded seam was discovered in Irvington Tunnel No. 1 during the inspection in 2015. The SFPUC will cover the seam with an epoxy coating (or equivalent) during the next service opportunity. The scheduled outage of Irvington Tunnel No. 1 is currently not a priority. Collectively, these areas are not considered to present a significant health risk to customers, particularly when coupled with the corrosion control for the RWS. Recent sampling also confirms that the RWS easily complies with concentrations outlined in the lead and copper rule (LCR).

Joints for wrought-steel pipelines were riveted, as were the longitudinal seams that sealed the edges of the rolled-steel plates. Active pipelines from this period are a portion of the original SAPL No. 1, the 54-inch portion of CSPL No. 2, and BDPL No. 1.

For a brief period during the 1920s, design for large-diameter pipelines used a longitudinal mechanical "lockbar" that fastened the edges of rolled-steel plates, thus replacing longitudinal rivet courses. Only one such pipeline remains active, the 54-inch SAPL No. 2, constructed in 1928; SAPL No. 2 has riveted joints (except north of Merced Manor, where the pipeline is welded steel). Many sections of the lockbar pipeline are now scheduled for replacement, following a major failure in July 2015 that revealed significant corrosion.

Welded steel pipe (WSP) was developed in the early 1930s, and most construction contracts for the RWS used WSP during this time. Longitudinal seams are welded in the shop during fabrication with an automatic arc-welding process. Circumferential joints are arc welded in the field by hand.

Also during the 1930s, reinforced concrete cylinder pipe (RCP) was developed: a steel cylinder with high-strength concrete cast on both sides of the cylinder and reinforcing steel bars embedded in the concrete outside the cylinder. Portions of BDPL Nos. 2 and 3, the upstream portion of BDPL No. 1, and Alameda Siphon No. 1 are RCP.

Prestressed concrete cylinder pipe (PCCP) was developed in the 1950s. The design used less steel in pipe and relied on high-strength wire wound to high tension around a concrete core to develop compressive strength in the pipe. In the 1960s, the SFPUC began to offer PCCP as an option to bidders for pipeline construction. Two sections of BDPL No. 4, Alameda Siphon No. 3, portions of CSPL No. 3, and the Crystal Springs Bypass Pipeline were constructed with PCCP, for a total of 28 miles, all completed by 1988. In addition, HHWP has about 6.25 miles of PCCP. Because PCCP can fail suddenly and violently, the SFPUC no longer offers PCCP as an option for new pipelines. WSP is specified instead. Steel pipes initially cost more than PCCP, but do not have the catastrophic failure consequences. The required internal inspection frequency and the cost of the inspections are also less with steel pipe. Taps for new service connections and appurtenances can be made easily with steel pipe. However, extensive modifications are required with PCCP. Leaks on steel pipe are generally more manageable and repairs can be done with less complication and cost. With proper corrosion protection, steel pipe should last longer than PCCP. In general, O&M is less expensive with steel pipe than with PCCP. More analysis would be needed to compare life-cycle costs. From the recent inspection of PCCP pipelines, most of pipelines are shown to be in good condition and safe to be continuing to operate (inspections are discussed in Section 3.3.2). To replace all PCCP in the RWS is a huge undertaken that will likely to cost hundreds of millions of dollars. The current plan with operations of PCCP is to continue perform electromagnetic and manned inspection every 10-year to monitor for distress growth. We are also considering Acoustic Fiber Optic (AFO) system to continuously monitor for wire breaks for high consequence of failure areas.

Appendix D contains a table listing the inventory and condition of RWS (active) pipelines and tunnels. The table provides information about pipeline and tunnel material, lining, and coatings; leak history and summarized results from inspections; construction modifications; cathodic protection (CP); and maintenance. A significant part of the maintenance program is dedicated to pipeline and tunnel inspection and repair (see Section 4.2). Additionally, the RWS experiences between three and five leaks per year that require immediate repair. Most of these leaks are repaired without a pipeline shutdown or depressurization. Others, such as failures of prestressed pipeline, require complete pipeline dewatering and internal repair or replacement of individual pipeline segments.

Appendix A also provides other pipeline and tunnel specifications, including length, capacity, and installation date. In addition to this report, the SFPUC's "Data Book" (updated in 2011) provides extensive detail on pipelines and tunnels.

The WSIP included seven additional conveyance facilities: Alameda Siphon No. 4, San Antonio Backup Pipeline (SABPL), New Irvington Tunnel (NIT), BDPL No. 5, New Crystal Springs Bypass Tunnel, extension of SAPL No. 3, and SJPL No. 4. Additionally, 16 sections of CSPL No. 2 will be repaired. The CIP includes placeholder pipeline R&R projects that will be initiated following the WSIP. To date, these projects include replacement of additional reaches of SAPL No. 2 and additional repairs to CSPL No. 2 not covered under the WSIP; additional seismic upgrades to SAPL Nos. 2 and 3 not covered under the WSIP; and repair or replacement of BDPL No. 4, Sections A and D (PCCP sections).

San Joaquin Pipelines

There are four SJPLs, however only three (SJPL Nos. 1, 2, and 3) extend the entire 47.5 miles across the San Joaquin Valley. SJPL No. 4 has a 6.7-mile-long eastern reach beginning at Oakdale Portal and a 10.5-mile-long western reach ending at Telsa Portal. The SJPLs were constructed over an 80-year period. SJPL Nos. 1 through 4 were completed in 1934, 1953, 1968, and 2014, respectively. The purpose of the pipelines is to convey Hetch Hetchy water across the San Joaquin Valley, from Foothill Tunnel to CRT. Ancillary facilities such as throttling stations, crossover valve vaults, metering facilities, and pressure relief facilities are part of the overall SJPL network.

Pipeline materials vary and include WSP, RCP, and PCCP. The only reach of PCCP is on SJPL No. 3, beginning at Oakdale Portal and running 6.25 miles west. In 2009, eddy current technology was used to estimate the existing number of wire breaks in the PCCP. Acoustic fiber optics are used to monitor additional wire breaks. Total wire breaks are monitored to ensure they remain below given threshold levels to minimize risk of unplanned outages.

Lower Cherry Aqueduct

The LCA provides the SFPUC with access to either Lake Lloyed or Lake Eleanor storage for drinking water purposes in an emergency or drought condition.

Alameda Siphons

The Alameda Siphons include four pipelines (AS-1 through AS-4) that stretch approximately 3,000 feet across the Sunol Valley from the AEP of the CRT to AWP. The siphons have been constructed of various materials and at various times over the years. The first was constructed in 1934 and the fourth in 2011 as part of the WSIP. They cross the Calaveras Fault and Alameda Creek. The portions of the siphons in the fault zone are considered susceptible to failure due to ground surface rupture. The recently added AS-4 has been designed with special provisions to allow it to withstand these seismic events.

Water flowing through the siphons originates from Hetch Hetchy and/or the SVWTP. The characteristics of the two sources, primarily hardness and alkalinity, vary significantly. The siphons therefore include the mixing manifold, which is designed to blend the water from the two sources to provide water of uniform characteristics downstream. The mixing manifold is downstream of the siphons.

Calaveras Pipeline

The Calaveras Pipeline extends approximately 6 miles from the outlet tower of Calaveras Reservoir northward to the San Antonio Pump Station (SAPS). The pipeline was initially constructed in 1965, with major upgrades in 1992. This WSP pipeline ranges in diameter from 44 to 78 inches. The portion of the pipeline at Calaveras Dam was replaced as part of the recent WSIP. The pipeline has four functions, including:

- conveying water from Calaveras Reservoir to the SVWTP;
- conveying water from Calaveras Reservoir to the Calaveras Creek discharge point;
- conveying water from Calaveras Reservoir to San Antonio Reservoir by gravity; and
- conveying water pumped by SAPS from either San Antonio or the Hetch Hetchy system to SVWTP.

San Antonio Pipeline and San Antonio Backup Pipeline

The San Antonio Pipeline was constructed in 1967 to connect San Antonio Reservoir to the SAPS and the Hetch Hetchy transmission system at the Alameda Siphons. The SABPL was constructed under the WSIP. The San Antonio Pipeline extends from the Alameda Siphons and SAPS to the outlet structure in San Antonio Reservoir, and SABPL extends from the Alameda Siphons to the SMP 24 Quarry Pit F3 East.

The San Antonio Pipeline serves several very important purposes, including:

- transferring water from the transmission system for storage or discharge;
- transferring water from Calaveras Reservoir to San Antonio Reservoir to optimize storage in the two reservoirs;
- transferring water from San Antonio to SVWTP, either by gravity or via pumping at SAPS, depending on system hydraulics;
- recapturing water discharged to SMP 24 Quarry Pit F3 East by transferring to San Antonio Reservoir; and
- releasing water from the reservoir to San Antonio Creek.

The SABPL provides the SFPUC with greater flexibility in managing the water quality of the system while maintaining supply to customers through SVWTP. This function allows the SFPUC to meet WSIP LOS goals during an unplanned outage of the Hetch Hetchy water supply.

Bay Division Pipeline Nos. 1, 2, and 5

BDPL Nos. 1, 2, and 5 are aligned in a relatively direct line westward from the Irvington Portals in Fremont to the Pulgas Valve Lot in Redwood City, a distance of approximately 21.5 miles. BDPL No. 1 was constructed in approximately 1925, and BDPL No. 2 was constructed in 1935/1936. BDPL No. 5 was recently constructed as part of the WSIP, together with the new Bay Tunnel. With the new Bay Tunnel transmitting the combined flow from the three pipelines, BDPL Nos. 1 and 2 across the Bay have been decommissioned.

BDPL Nos. 1, 2, and 5 cross the Hayward Fault and therefore can be particularly impacted by major seismic events on that fault.

The East Bay Reach is approximately 37,600 feet (7.1 miles) in length. A significant natural feature in this reach is the Hayward Fault crossing, downstream of the Irvington Portals.

Seismically resistant crossings of the fault were constructed under the WSIP. The initial (easternmost) 6,800 feet of BDPL No. 1 is constructed of 57-inch-diameter steel-cylinder concrete pipe; the remainder is 60-inch-diameter riveted steel pipe. The first 6,800 feet of BDPL No. 2 is constructed of 62-inch-diameter steel-cylinder concrete pipe; the remainder is of 66-inch-diameter wrought steel. BDPL No. 5 is constructed of 72-inch-diameter WSP.

The Peninsula Reach is approximately 47,900 feet (9.06 miles) in length. BDPL No. 1 is constructed of 60-inch-diameter riveted steel pipe. BDPL No. 2 is constructed of a combination of 66-inch wrought steel pipe and 62-inch steel-cylinder concrete pipe. BDPL No. 5 is constructed of 60-inch-diameter WSP.

The portion of BDPL No. 5 that crosses below the Bay is known as the Bay Tunnel. The tunnel has a 9-foot finished diameter and is approximately 26,200 feet (5 miles) in length. The tunnel, which is 70 to 110 feet below the Bay floor, extends from the Newark Valve Vault and Tunnel Portal to the Ravenswood Valve Lot and Tunnel Portal.

Bay Division Pipeline Nos. 3 and 4

BDPL Nos. 3 and 4 proceed southward from the Irvington Portals, circling around the southern end of the bay, through the northern part of San Jose and Santa Clara, and then northward to the Pulgas Valve Lot in Redwood City. This alignment is significantly different than that for BDPL Nos. 1, 2, and 5, providing increased reliability and the ability to efficiently serve the numerous wholesale customer turnouts. Each pipeline is approximately 33.9 miles in length. BDPL No. 3 was constructed in 1952 and BDPL No. 4 was constructed in 1967.

BDPL Nos. 3 and 4 cross the Hayward Fault and therefore can be particularly impacted by major seismic events on that fault. The diameters of the pipelines range from 72 to 96 inches, and pipelines materials include steel-RCP, PCCP, and WSP. Before the WSIP, the distance between crossover points on these two pipelines spanned approximately 8 miles. This large distance made it difficult to take segments of pipe out of service for planned inspections and maintenance. The BDPL Nos. 3 and 4 Crossovers project added three additional isolation/ crossover facilities, so that the distance between crossover points is approximately 4 miles, making the system easier to maintain and repair, and increasing the number of customers that would likely receive water within 24 hours following a major seismic event. The three new crossover facilities are near the Guadalupe River, near Barron Creek, and near Bear Gulch.

BDPL Nos. 3 and 4 cross the Hayward Fault near the intersection of Mission Boulevard and Interstate 680. The maximum credible seismic event would have resulted in probable failure of both pipelines. For BDPL No. 3, a new 300-foot-long concrete vault with articulating sections has been constructed under Mission Boulevard.

The vault houses a section of 72-inch-diameter WSP, with ball joints and slip joints that will accommodate pipeline displacement during a seismic event. BDPL No. 4 is designed to fail in a controlled manner that does not cause failure to BDPL No. 3. The seismic upgrade of BDPL Nos. 3 and 4 provides a seismically reliable conduit crossing the Hayward Fault.

BDPL Nos. 3 and 4 converge into the Stanford Tunnel. This tunnel is 1,358 feet long and 90 inches in diameter, and is constructed of cement-lined and coated-steel pipe.

Crystal Springs Pipelines

The CSPLs transport Hetch Hetchy and/or Sunol water to water customers along the Peninsula and the potable water terminal storage reservoirs in the City of San Francisco. CSPL No. 1 is currently not in service, except for a small rehabilitated section. CSPL Nos. 2 and 3 both carry Hetch Hetchy water north to the City of San Francisco across approximately 20 miles, by gravity. University Mound Reservoir is the terminus for CSPL Nos. 1, 2, and 3. The operating portions of CSPL No. 1 were replaced with 44-inch-diameter WSP. CSPL No. 2 ranges in diameter from 54 to 60 inches, and construction materials include WSP and riveted wrought iron with welded steel slipline. CSPL No. 3 is 60-inch PCCP.

Sunset Supply Pipeline

The SSPL transports water from the Hetch Hetchy System north to the City of San Francisco across approximately 20 miles, by gravity. The pipeline is 60 inches in diameter and constructed of WSP. The SSPL delivers water to the Sunset Reservoir ("high zone") after being pumped at the LMPS. Flow through the SSPL is controlled at a number of valves and valve lots along its alignment. The SSPL can also receive pressure-reduced high zone flow from the 60-inch Sunset Branch Pipeline via the Capuchino Pressure-Reducing Valve.

San Andreas Pipelines

SAPL Nos. 2 and 3 are the primary high zone transmission lines for the SFPUC water system. From HTWTP, SAPLs Nos. 2 and 3 parallel each other up to San Pedro Valve Lot and supply water to high zone service locations in the northern Peninsula and the CCSF. The terminus of the SAPLs or the high zone is the Sunset Reservoir.

SAPLs Nos. 2 and 3 are interconnected at both Baden Pump Station and San Pedro Valve Lot. At San Pedro, SAPL No. 3 ends and is connected to SAPL No. 2 via a 48-inch butterfly valve (T60). T60 is throttled remotely from HTWTP to regulate high zone flow to San Francisco. SAPL No. 2 is made of 54-inch steel and SAPL No. 3 is made of steel and PCCP, some of which has been sliplined with steel.

Tunnels

Canyon Power Tunnel

Canyon Power Tunnel, built in 1965, is a 10.8-mile-long tunnel that conveys water from O'Shaughnessy Dam to Kirkwood Penstock. The majority of the tunnel is horseshoe-shaped, and it measures approximately 14 feet by 14.5 feet.

Early Intake Bypass Tunnel

Early Intake Bypass is a 0.4-mile-long tunnel that conveys water from Kirkwood Powerhouse directly into the Mountain Tunnel. The tunnel is horseshoe-shaped, varying in diameter from 10 feet to about 14.5 feet.

Mountain Tunnel

Mountain Tunnel is a critical water conveyance facility for the Hetch Hetchy Aqueduct source. Built between 1917 and 1925, Mountain Tunnel extends 19.2 miles from Early Intake Dam to

Priest Reservoir. The majority of the tunnel is horseshoe-shaped, and it measures approximately 14 feet by 14.5 feet. The first 7.2 miles of Mountain Tunnel west from Early Intake are unlined, with the exception of small lined areas at each adit and a short section approximately 400 feet east of South Fork Adit. Nine of the remaining 12 miles of tunnel are lined. Recent inspections have shown signs of deterioration in the lining, which will likely increase over time.

Moccasin Power Tunnel

Moccasin Power Tunnel is a 1-mile-long tunnel that conveys water from Priest Reservoir to the Moccasin Penstocks. Most of the tunnel is horseshoe-shaped, and it measures approximately 13 feet by 13 feet.

Foothill Tunnel

Foothill Tunnel is a 16.3-mile-long tunnel that conveys water from Moccasin Reservoir to Oakdale Portal, the entrance to the SJPLs. The majority of the tunnel is horseshoe-shaped, and it measures approximately 14 feet by 14 feet.

Eleanor-Cherry Tunnel

Eleanor-Cherry Tunnel is a 1.1-mile-long tunnel that conveys water from Lake Eleanor to Lake Lloyd. The tunnel is horseshoe-shaped, and it measures approximately 8.5 feet by 8.5 feet.

Coast Range Tunnel

The CRT is a 28.6-mile-long tunnel that conveys wastewater from TTF, just downstream of the SJPLs, to AEP. The finished diameter of the lined tunnel is 10.5 feet.

Irvington Tunnels Nos. 1 and 2

There are two Irvington Tunnels: the original Irvington Tunnel (No. 1) was constructed in 1934; the NIT (now No. 2) was completed in 2014 as part of the WSIP. All of the water supplied from Hetch Hetchy and the SFPUC's two East Bay reservoirs flows westward through these two tunnels from the Sunol Valley to the BDPLs.

The original Irvington Tunnel is 18,193 feet long and has a 10.5-foot inside diameter. The tunnel is completely lined with either concrete or gunnite.

The NIT is slightly longer, with a length of 18,300 feet. This tunnel was excavated in a shape resembling a horseshoe, with dimensions of approximately 12.5 by 12.5 feet. The NIT has a 8.5-foot finished diameter welded steel pipe with cement mortar lining. The lining is welded steep pipe with cement mortal lining. In 2014, the NIT was completed under the WSIP, disinfected, and brought into service. The NIT was subsequently named Irvington Tunnel No. 2, with the original tunnel being designated as Irvington Tunnel No. 1. Both tunnels are typically left on line under normal operations.

Bay Tunnel

The Bay Tunnel was completed in 2016 as part of the WSIP, to replace BDPL Nos. 1 and 2 and, as described above under the heading *Bay Division Pipeline Nos. 1, 2, and 5*, to transmit water across San Francisco Bay. The Bay Tunnel has a 9-foot finished diameter welded steel pipe with cement mortal lining. The tunnel is approximately 26,200 feet in length. The tunnel, which is 70 to 110 feet below sea level, extends from Newark Valve Lot and Tunnel Portal to the Ravenswood Valve Lot and Tunnel Portal.

Pulgas Tunnel

The Pulgas Tunnel was constructed in 1924. Its sole original purpose was to transmit water from the BDPLs at the Pulgas Valve Lot to the Peninsula Reservoirs. In 1969, the Crystal Springs Bypass System was constructed to enable water from the Pulgas Tunnel to be diverted northward directly to the low-pressure zone pipelines on the northern portion of the Peninsula. The Pulgas Overflow Channel is the release point for excess water in the Regional System, discharging water from the tunnel to UCSR. It is also the first "daylight" point for Hetch Hetchy water.

Crystal Springs Bypass Facilities

The Crystal Springs Bypass Tunnel was constructed and put into service in 1969. Water that is supplied from Hetch Hetchy and the East Bay Reservoirs (via the SVWTP) is transmitted from the mid-Peninsula to the northern portion of the Peninsula through the Pulgas Facilities and/or the Crystal Springs Bypass Facilities. The Pulgas Tunnel conveys water from the Pulgas Valve Lot to either the Crystal Springs Bypass Facilities or the Peninsula Reservoirs. The Crystal Springs Bypass Facilities, which include the Crystal Springs Bypass Tunnel, New Crystal Springs Bypass Tunnel, and Crystal Springs Bypass Pipeline, allow water to be transmitted by gravity directly to the low-pressure zone pipelines on the northern portion of the Peninsula, thereby bypassing the Peninsula Reservoirs and HTWTP.

Hillsborough Tunnel

The Hillsborough Tunnel, collinear with the Sunset Supply Pipeline, was constructed in 1957. It is approximately 5,200 feet long and 7.5 feet in diameter. The entire length of the tunnel is lined with steel pipe.

Standford Tunnel

The Bay Division Pipelines Nos. 3 and 4 converage at Stanford Tunnel Valve House East, travel for the 810-foot length of Stanford Tunnel and diverage and continue on again as separate pipelines at Stanford Tunnel Valve House West. Stanford tunnel was constructed in 1952. It is approximately 810 feet long and 7.5 feet in diameter. The entire length of the tunnel is lined with steel pipe.

Penstocks and Powerhouses along the RWS

Kirkwood Penstock and Powerhouse

The Kirkwood Penstock and Powerhouse convey water from Canyon Power Tunnel to Early Intake Bypass Tunnel. Kirkwood Penstock was built in 1964. Kirkwood Powerhouse was originally built with two hydro-generating units in 1967. A third unit was added in 1987. The powerhouse functions as a control point for water deliveries. Integrated into the powerhouse is a generator bypass, which allows deliveries of up to 280 mgd water to be made when the units are deenergized.

Moccasin Penstock, Powerhouse, and Lowhead Powerhouse

The Moccasin Penstocks and Powerhouse convey water from Moccasin Power Tunnel, downstream of Priest Reservoir, to Moccasin Reservoir. Moccasin Penstock was built in 1925, with new sections completed in 1969. Moccasin Powerhouse contains two hydro-generating units and was completed in 1969. Integrated into each unit is a generator bypass, which allows water deliveries to be made when the units are deenergized. The diversion capacity of each generator bypass is about 150 mgd (a total of about 300 mgd).

Pump Stations

San Antonio Pump Station

The SAPS was constructed in 1968 and subsequently modified in 1992 and 2011. The latest modifications provided new electric motors for the larger pumps, emergency generators, and general seismic reliability upgrades. SAPS is integral to the operation of the facilities in the Sunol Valley and operates to transfer water between the various facilities, including the Alameda Siphons, San Antonio Reservoir, and SVWTP.

Pulgas Balancing Reservoir and Pump Station

The Pulgas Pump Station and Balancing Reservoir were constructed in 1975. The facilities function to dampen pressure fluctuations and maintain the hydraulic gradeline in upstream Pulgas Tunnel and the Crystal Springs Bypass Tunnel. The Pump Station wetwell also serves as the diversion point for water to be released to the Peninsula Reservoirs. The reservoir has a 60-million-gallon capacity. The roof of the Pulgas Balancing Reservoir was rebuilt under the WSIP to improve seismic performance.

Crystal Springs Pump Station

The CSPS and associated valve lot are below Lower Crystal Springs Dam (LCSD). The primary purpose of these facilities is to transfer water from LCSR to San Andreas Reservoir approximately 4.5 miles north. The CSPL/SAPL transmits the water from LCSR to San Andreas Reservoir. LCSR has a maximum water surface elevation of 288 feet compared to 449 feet for San Andreas Reservoir. The water is subsequently used to supply the HTWTP. The entire CSPS and adjacent large-diameter yard piping/valving have recently been completely replaced as part of the WSIP.

Baden Pump Station and Valve Lot

The Baden Pump Station and Valve Lot (Baden) are at the intersection of El Camino Real and West Orange Avenue in South San Francisco. Baden includes the interconnecting valves and pumps necessary to isolate pipeline reaches, transfer between the high-pressure and low-pressure zones, and transfer between pipelines of the same pressure zone.

The facility includes multiple interconnections between the two high-pressure service zone pipelines (SAPL No. 2 and SAPL No. 3) and between the four low-pressure service zone pipelines (SSPL, CSPL No. 2, CSPL No. 3, and SAPL No. 1). There is also a pressure-relief valve (PRV) station that allows transfer of water from the high-pressure zone to the low-pressure zone.

Valves and Valve Lots

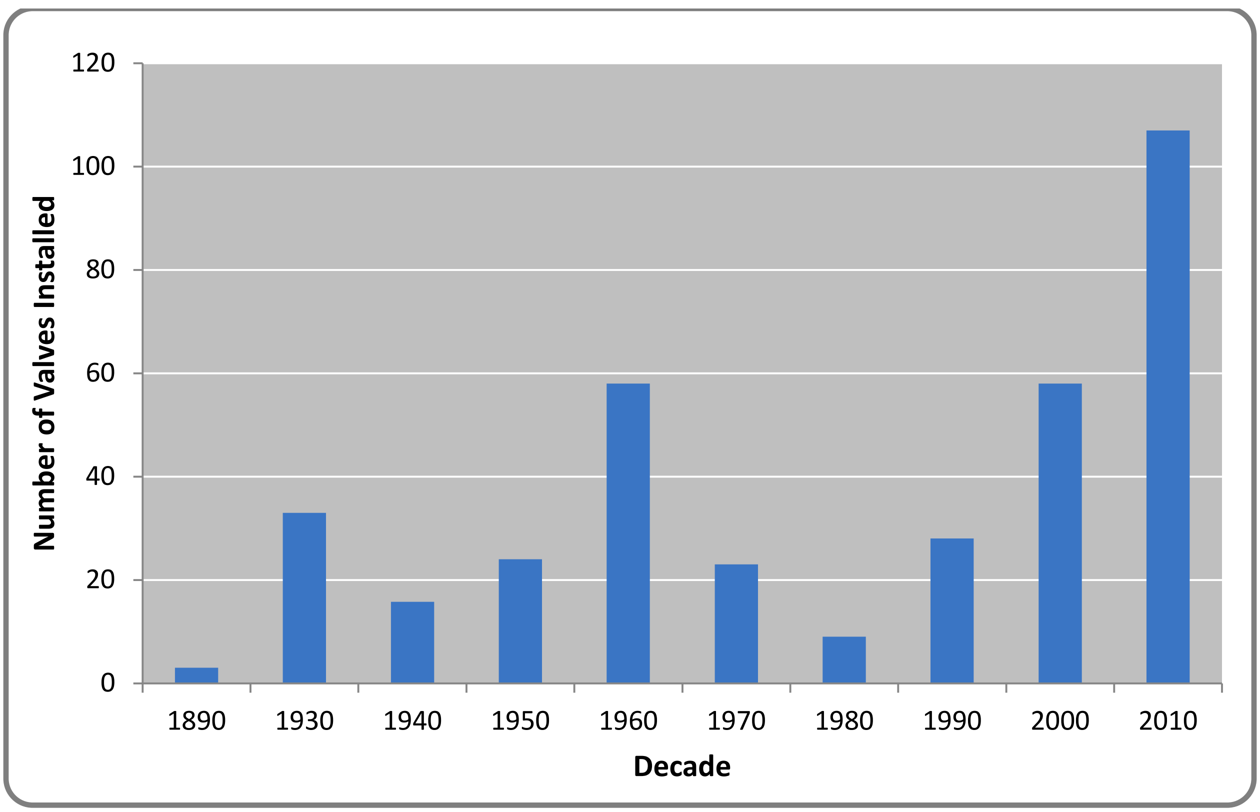
Inventory and Condition

The RWS includes more than 350 valves of various sizes, types, functions, and periods of installation. A complete 2018 inventory of main-line valves of the transmission system is shown in Table A-8 in Appendix A (a complete description for valves west of the CRT is housed in WSTD's *Valve Book Database*). Bypass valves and service connection valves are not included. Approximately 50 major valves were added under the WSIP. In most cases, valves more than 50 years in age have been rebuilt or replaced.

Many new valve lots have been added in the last 10 years (Figure 2-5) just prior to and as part of the WSIP. These include the cross-over valve lots on BDPL Nos. 3 and 4, where six facilities were completed, with the final two substantially completed in FY12. These valve lots significantly improve the SFPUC's ability to operate around unplanned outages of one of these pipelines. The Paseo Padre and Grimmer valve lots on BDPL Nos. 1, 2, and 5, and the Tissiack/ Crawford vaults on BDPL Nos. 3 and 4 support emergency earthquake recovery by enabling the system to be isolated on either side of the Hayward Fault.

In the San Pedro Valve Lot, two valve vaults were seismically upgraded, electric valve operators were modified, a new air valve was installed, and miscellaneous site drainage improvements were made. Elsewhere under the WSIP, a variety of valves (line and cross-over) are being replaced/added in SAPL Nos. 2 and 3.

Figure 2-5: Number of Valves Installed by Decade



San Joaquin Valve House

The San Joaquin River Valve House is just to the east of the San Joaquin River. This facility, which is at nearly the lowest pipeline elevation, provides automatic PRVs for SJPL Nos. 1, 2, and 3. This facility is also an important process monitoring point for pH, turbidity, conductivity, temperature, and pressure.

Oakdale Portal

The Oakdale Portal provides the transition from the Foothill Tunnel to the SJPLs. It also provides surge protection and a location to blow off sand and small rocks that may have entered the tunnel at upstream locations.

Crossovers

There are three crossover facilities on the SJPL network: Emery, Roselle, and Pelican. The purpose of these facilities is to facilitate the shutdown of upstream or downstream segments of SJPL Nos. 1, 2, 3, or 4 (SJPL No. 4 at Pelican Crossover only). The facility allows water to be transferred between pipelines in a manner that minimizes loss of system capacity when taking adjacent reaches of pipeline out of service.

Tesla Portal

The Tesla Portal provides the transition from the SJPLs to the TTF, which is just upstream of the CRT.

Alameda East Portal

AEP of the CRT is in the hillside to the east of Calaveras Road. The Calaveras Fault Zone lies several hundred feet west of this location. The portal includes a 10.5-foot-diameter steel pipe with three pipe connections to distribute water to the four Alameda Siphon pipes. Additionally, the portal overflow shaft includes a catchment basin and an emergency overflow pipeline discharging to an adjacent quarry pit. Water is treated prior to discharge to the quarry. AEP was upgraded as part of the recent WSIP to provide the additional connection for Alameda Siphon No. 4 (AS-4), and increased seismic reliability.

Irvington Portals

Water from Hetch Hetchy and the East Bay Reservoirs is conveyed from the Sunol Region to the Bay Region through the parallel Irvington Tunnels Nos. 1 and 2. The Irvington Portals provide the facilities to isolate each tunnel on its downstream end, distribute water to the five BDPLs, and isolate each pipeline on its upstream end.

Pulgas Valve Lot

The Pulgas Valve Lot, near the intersection of Edgewood and Crestview Roads in Redwood City, is the western terminus of the Bay Region. The purposes of this facility are to combine the flows from the five pipelines just upstream of the Pulgas Tunnel, maintain the pressure in the upstream reach of pipe, provide isolation for the upstream reaches of pipe, and measure and totalize the flow rate for reporting purposes.

Capuchino Valve Lot

The Capuchino Valve Lot is one of two valve lots designed to reduce pressure from the high- to low-pressure zone pipelines (the other PRV location is at Baden). The rated capacity of the facility is 80 mgd.

Interties

The SFPUC co-owns an intertie in Hayward with East Bay Municipal Utility District (EBMUD) (the facility is operated by the City of Hayward per agreement). The SFPUC also co-owns an intertie with Santa Clara Valley Water District (SCVWD) in Milpitas. Each intertie offers the principal parties access to other regional water suppliers in emergencies or during planned maintenance. Each intertie has been thoroughly tested; the EBMUD intertie was completed in 2007 and the SCVWD intertie was completed in 2004. The interties were simultaneously operated in 2010. Maintenance requirements are developed each year for the interties. The City of Hayward is the designated lead for O&M at the EBMUD intertie. The SFPUC has the lead maintenance role for the SCVWD intertie (as of January 1, 2014). This role was passed on to SCVWD for 5 years while the WSIP was under construction. The role has now reverted to the SFPUC.

The California Department of Water Resources (DWR) and the SFPUC agreed in FY11 to disconnect the “temporary” raw water intertie between the South Bay Aqueduct and the SFPUC’s system in the Sunol Valley, originally constructed in 1991. The intertie was characterized as a seismic vulnerability to the South Bay Aqueduct; without expensive upgrades, DWR’s preference was to disconnect it. This decision was first vetted with the South Bay Aqueduct contractors, and is reversible if conditions change. Much of the utility of this intertie was replaced by the other intertie with SCVWD mentioned above. The one-way (to the SFPUC) tie-in at the San Antonio Reservoir remains.

Distribution Systems

Aside from a small number of individual residential and commercial customers outside of San Francisco, RWS retail operations are limited to distribution systems in the Town of Sunol, Moccasin, Cherry Compound, O’Shaughnessy Compound, and Early Intake.

In FY15 and FY16, the Town of Sunol system was upgraded, adding a nonpotable fire system and replacing the potable storage tanks. No additional work was performed in FY17 and FY18 on this system.

Since 2012, the distribution system for the Castlewood community (non-SFPUC) has been managed by the City of Pleasanton under contract with the Castlewood Homeowners Association.

2.2.3 Water Treatment Facilities

The RWS uses three major treatment facilities. These include two filtration plants, which treat local watershed water; and the TTF, which treats Tuolumne-based supplies. Improvements at HTWTP performed under the WSIP were substantially completed in the fall of 2014. WSIP improvements at SVWTP were completed in the summer of 2013; however, additional drought-related improvements needed to ensure reliable operation for potential long-term treatment of water from Lake Lloyd are ongoing. Construction of TTF under the WSIP was completed in 2011.

Other significant treatment facilities include the Rock River Lime Plant, Thomas Shaft Chlorination Facility, SVCF, and the Pulgas Dechloramination Facility. These facilities, along with small treatment facilities that are part of the supporting utilities at remote SFPUC locations, are listed in Appendix A-5.

Harry Tracy Water Treatment Plant

HTWTP, in San Bruno, was originally constructed in 1972, and significant WSIP improvements were completed in 2014. HTWTP supplies the high-pressure zone customers on the Upper Peninsula and San Francisco. Local water is pumped from Crystal Springs Reservoir to San Andreas Reservoir, where it enters HTWTP. The plant is a 160-mgd direct filtration plant that uses ozone as its primary disinfectant. After the filtration process, chlorine and ammonia are added to produce chloramines. Water is pH-corrected and fluoridated before leaving the plant and entering the transmission system for public consumption. HTWTP has been significantly modified to meet the LOS goals established under the WSIP. Five new filters were added; chemical tanks were relocated; and, due to seismic concerns, the contactor chamber and a new 11-million-gallon treated-water reservoir were located on more stable ground. The project also included improvements to the sludge handling, and a new washwater tank to enhance the plant's performance. Additional improvements included a new substation, switchgear, and motor control center. The conveyance structures that bring water from San Andreas Reservoir to HTWTP were rebuilt to the current seismic code.

Sunol Valley Water Treatment Plant

SVWTP was originally constructed in 1966, and significant WSIP improvements were completed in 2013. The SVWTP is a 160-mgd conventional filtration plant. Water from the Calaveras and San Antonio Reservoirs is brought by gravity to the facility, where it goes through the filtration process (use of SAPS is required to convey water from San Antonio Reservoir to SVWTP when higher flow rates are needed). Although an operational rarity, Hetch Hetchy (or Cherry/Eleanor) water can be treated at the plant via SAPS to mitigate water quality issues that may arise. Water leaving the plant is chloraminated and pH-corrected before entering the Alameda Siphons. The plant is unique in that influent water passes through a distribution structure that channels the water to individual treatment trains. This allows different treatment processes for the differing raw water sources. This is very effective because the low-alkalinity Hetch Hetchy water is difficult to treat if blended with local source waters. The WSIP project upgraded the existing filters and added a new sedimentation basin. A treated-water reservoir was also added. These upgrades greatly improved the plant's reliable capacity and corrected deficiencies associated with not having a treated-water reservoir. Since WSIP project closeout at the SVWTP, WSTD has replaced existing chemical piping, replaced valves in the sludge lagoons, made drainage improvements near an existing electrical building, and installed safety hand rails around four existing sedimentation basins; and is in the process of relocating the SCADA server room and installing PAC facilities as an interim measure to address T&O issues. A major future upgrade to the plant is planned to be constructed within the next 5 years to add ozone treatment to address T&O issues.

Tesla Treatment Facility

The TTF is situated at the entrance to the CRT, near the City of Tracy. The facility employs UV irradiation and disinfection for Hetch Hetchy supplies. In addition to UV treatment at this facility, the pH is adjusted using carbon dioxide, fluoride is added, and secondary disinfection begins with the addition of chlorine. The UV systems were first brought on line during the summer of 2011. The regulatory requirement for UV treatment began in April 2012. Uninterrupted chemical dosing with sodium hypochlorite is critical for public health protection, and to maintain operating permit requirements with the SWRCB DDW. Should there be a failure of chemical feed equipment at Tesla Portal, the Thomas Shaft Chlorination Facility, about 3 miles west of Tesla on the CRT, will automatically start up and provide continuous disinfection. The detention time necessary for complete disinfection is obtained within the 25-mile length of the CRT.

Aside from the filter plants and TTF, there are two other major treatment facilities in the Bay Area. As water passes through the Sunol Valley, further treatment is performed at SVCF. The chlorine residual is trimmed, ammonia is added to form chloramines, and water is pH-corrected and fluoridated. Finally, the Pulgas Dechloramination Facility removes excess chlorine and ammonia from water discharging into Crystal Springs Reservoir (and adjusts pH). These discharges serve to replenish supplies in Crystal Springs Reservoir and also provide necessary relief from pipeline overpressurization when system hydraulics change.

Rock River Treatment Facility

The Rock River Lime Plant is situated along Foothill Tunnel. The plant doses Hetch Hetchy water deliveries to the RWS with hydrated lime to raise the pH and alkalinity of the water for SJPL corrosion control. The plant was rehabilitated in 2010 and 2011. In 2010, the facility was upgraded with rotary mixers, new feeders, and safety enhancements. The upgrade to rotary mixers allows more control at very low dosage rates. In 2011, the building was rehabilitated (new windows, interior stairs, and roof flashing were installed, and interior/exterior painting was done). In 2017, temporary piping was installed to deliver the slurry to Foothill Tunnel. The existing pipe works had become restricted due to buildup of lime inside. A permanent replacement of the pipe is scheduled for 2019.

Thomas Shaft Hypochlorite Station

Thomas Shaft of the CRT has two functions. First, it is a standby chlorination facility, to be used in the event of operational difficulties at Tesla; second, it is used for disinfection of the water supply for customers in the region. The latter function is required because the distance of these customers from Tesla does not provide sufficient contact time to allow the water to comply with disinfection requirements at higher flow rates.

Sunol Valley Chloramination Facility

As part of the recent WSIP, some portions of the SVCF were modified from previous uses and other portions were newly constructed. The SVCF now has two functions during normal operations. These include:

- ammonia addition and hypochlorite trim for chloramination of Hetch Hetchy water; and
- caustic addition for pH adjustment of the Hetch Hetchy water, if required.

In the event that water does not meet drinking water standards and must be discharged to an adjacent quarry pit, San Antonio Creek, or San Antonio Reservoir, the facility provides dechlorination and pH adjustment of water being discharged. The dechloramination function is not currently in use.

Pulgas Dechloramination Facility

The purpose of the Pulgas Dechloramination facility is to treat the water being discharged from the Pulgas Tunnel into UCSR. Treatment includes dechloramination and pH adjustment. The treatment facilities are immediately downstream of the Pulgas Pump Station and Balancing Reservoir.

GSR Groundwater Production Wells

Treatment for water quality will take place at seven of the nine well stations that connect to the SFPUC's RWS. Treatment includes chloramination, pH adjustment, fluoridation, blending for chromium VI and nitrate, and blending or filtration for manganese. Treatment for manganese is not required at all well stations.

2.2.4 Building and Grounds

The inventory of buildings and grounds is listed in Tables A-14 through A-16 in Appendix A. This category includes corporation yards, administrative buildings, cottages, and other minor structures that support operations but are not otherwise part of other facility categories.

Sunol and Millbrae Yards

Most of the capital funding in this program is dedicated to redevelopment of the Sunol Corporation Yard and construction of the Alameda Creek Watershed Center near the Sunol Water Temple. Construction on the Sunol Yard began in 2017, and the design of Alameda Creek Watershed Center will begin in 2019. Major upgrades to the Millbrae Corporation Yard have been deferred beyond the 10-year CIP. Interim improvements at the Millbrae Yard include additional administrative space, server rooms, upgrades to the water quality laboratory, and minor shop upgrades.

Rollins Facility

The capital funding for the Rollins facility involves the renovation of the building at 1657 Rollins Road in Burlingame, California. This building was constructed in 1955. The SFPUC purchased this approximately 25,000-square-foot, single-story building (on an approximately 116,000-square-foot parcel) in September 2017. The facility improvements to the building will allow for the most efficient use of the office space for the current, future, and additional relocated staff from WQD, NRLMD, and Information Technology Bureau. The upgrades include renovation of the previously occupied medical examination space; a small building addition, to provide staging area and storage space for field equipment and supplies for the WQD field services group; and modifications to the existing layout of some of the offices, to meet the workspace functional and operational requirements. Based on the building condition assessments, LEED sustainability criteria, and building codes requirements, the modifications primarily involve security, mechanical, electrical, and civil/architecture upgrades. Such upgrades relate to server rooms; information technology (IT) communications equipment;

heating, ventilation, and air conditioning (HVAC) systems; electrical panels and conduits; generators; roof replacement; fences; and security systems / surveillance.

Moccasin Facilities

Recent upgrades to the Moccasin structures are highlighted by a new 5,000-square-foot Moccasin Control Room that houses the Moccasin dispatch center, the computer server room, the water operations control room, and staff. This project replaced the undersized Moccasin dispatch center in the Moccasin Powerhouse, and the server room on the bottom floor of the Administration Building. The new building meets current building code and Western Electricity Coordinating Council (WECC) / North American Electric Reliability Corporation security requirements. This project was completed in FY15. In addition, the Moccasin structures are highlighted by a new 10,800-square-foot building, the Moccasin Maintenance Repair and Tech Shop. The new building houses the Utility Plumbers, Moccasin ROW Crew, Tech Shop, and Business and Security Network Information Technology staff. The new building meets current building codes and is LEED Gold certified. The building was completed in FY 18.

Peninsula and Alameda Watershed Cottages

There are 18 cottages (three are decommissioned and three are inactive / vacant) throughout the Alameda and Peninsula watersheds. These serve as residences for employees, and in one case as an employee work center that enhances the SFPUC's ability to manage the watersheds. The condition, design, and size of the cottages vary greatly. Several have been completely replaced or comprehensively renovated. In recent years, the SFPUC has increased the rate of investment in these structures to reduce overall life-cycle costs and to satisfy tenants. Focused investments include roof and window repair, dry-rot repair, and exterior painting.

2.2.5 Watershed and Right-of-Way Lands

The SFPUC has significant land interests in the seven counties of the RWS, highlighted by the properties either owned in fee, Raker Act, easement, decree, or license in Alameda, San Mateo, San Joaquin, Stanislaus, Santa Clara, Mariposa, and Tuolumne Counties. The SFPUC expends significant effort managing watershed and ROW properties and the natural resources that depend on them. The economic value associated with these lands and natural resources—natural capital—is not recognized under current federal accounting standards and guidelines.

The SFPUC has been working with members of the Pacific Northwest Watershed Managers and other utilities to capture these values, and to advocate for including them in required financial reporting. These efforts and ongoing expenditures will be integrated into future reports.

The inventory of watershed lands is listed in Table A-11 in Appendix A. Detail on watershed lands and ROW asset inventories (e.g., miles of road, type, and location) and planned expenditures is limited and will be improved in future updates of this report. In general, the CIP for watershed and ROW lands includes O&M of roads, bridges, and fences; vegetation management (e.g., annual fire guarding); and biological monitoring required by federal and state environmental regulatory compliance permits. Assets for the RWS also include thousands of acres of property outside the watersheds used for various infrastructure, most notably pipelines and valve lots.

Tuolumne River Watershed and ROW

The SFPUC works jointly with the United States Forest Service to manage lands above Lake Lloyd, and with the National Park Service to manage the lands above Hetch Hetchy and

Eleanor reservoirs. This work is performed under agreements to support the water quality and security objectives of the SFPUC.

HHWP is responsible for 14 bridges and about 40 miles of paved roadways that provide access to facilities. Many of these bridges and roads are used by the public. Most of the roads and bridges were constructed many years ago; some are in need of repair, rehabilitation, and/or replacement. Though these roads and bridges fall under the purview of the Stanislaus Forest or the Yosemite National Park, it has been determined that the SFPUC is the legal entity responsible for maintaining and rehabilitating this infrastructure.

Bay Area Watersheds and ROW

NRLMD, with support from WSTD, is responsible for maintenance and operation of roads, fences, bridges, culverts, and annual fire risk reduction work (mowing, discing, and fuel breaks) in the Bay Area watersheds and ROW lands.

On the Peninsula Watershed, there are approximately 112 miles of roads (25 paved), 128 gates, 261 culverts (partial count), and three bridges. Annual fire risk reduction work includes approximately 90 miles of mowing, and 47 miles of fuel breaks.

On the Alameda Watershed, there are approximately 190 miles of roads (12 paved), 200 culverts (partial count), and five bridges. Annual fire risk reduction work is also extensive, and efforts to provide specific estimates are ongoing.

Annual fire risk reduction for the approximately 210 miles of ROW is also exstensive. NRLMD is working with WSTD to confirm the level of effort required to operate and maintain these watershed and ROW assets, and then regulary conduct conditions assessments and preventative maintenance activities. Ongoing improvements will be provided in future updates of this report.

2.2.6 Communication Systems

This category includes assets related to radio/telephone, SCADA, and security systems. These systems are usually independent and installed on many different platforms.

Radio/Telephone

Three seven-county one-way radio systems are used by the SFPUC's Water and Hetch Hetchy Power Systems. They consist of three separate radio systems, using different frequencies. In addition to being at the end of their life, these radio systems offer incomplete system hardware, incomplete coverage, and lack many features needed in today's utility business.

Telephone systems throughout the SFPUC primarily use Virtual Private Networks through AT&T. Upgrading network hardware has been contingent on and intertwined with WSIP projects. These systems are used for daily business communications and are not considered reliable or available during or following a disaster. Future considerations may include an assessment of Voice over Internet Communications for self-reliance and cost savings reasons.

SCADA

The WSTD SCADA systems continued to be responsive and reliable in meeting the operational needs of the RWS, with an overall availability greater than 99.95 percent. Upgrades to the Bay Area SCADA system hardware and software infrastructure focused on network reliability, performance, and security. The recently upgraded Ethernet communication network was further optimized. Existing process control was enhanced, and new facilities and processes took place. As part of the GSR project, nine new remote sites were added to the SCADA system.

Facility Security

Security review and site-specific upgrades continue at many facilities in the RWS. These upgrades include improved fencing, conversion to electronic card access, implementation of a rekeying plan, and expansion of video monitoring systems to minimize the risk of intrusion at facilities. A 10-year Security CIP has been prepared to identify security upgrades to facilities in the RWS. Appropriate details are presented later in this report.

2.2.7 Rolling Stock and Equipment

The operating divisions that maintain the RWS have an extensive inventory of rolling (and floating) stock, summarized in Table A-17 in Appendix A; this stock includes passenger cars, light trucks, heavy equipment (dump trucks, front-loaders, bulldozers, flatbeds, large cranes, etc.), trailer equipment (generator sets, light poles, wood chippers, etc.), boats, and other equipment. This fleet of rolling stock provides a major mutual aid resource to the region and statewide, and allows the SFPUC to be self-sufficient in most emergencies. There are no aircraft owned by the SFPUC, but some assistance can be provided by local law enforcement agencies, CAL FIRE, and the East Bay Regional Park District in emergencies.

3. Asset Management Program Overview

An asset management program allows a utility to minimize the total cost of owning and operating facilities, while delivering specified LOS at an acceptable level of risk. Asset management is an entire life-cycle process. Implementing such program requires a regular practice of acquiring data on assets, evaluation of these data to determine any shortcomings in maintenance or need for capital projects, implementation of modified maintenance practices or completion of capital upgrades, and a practice of documenting the resulting performance for later use.

The SFPUC is striving towards integration of the following functions that collectively create an asset management program as discussed in this chapter:

- **Define LOS:** Establish, publish, and regularly review LOS and related performance objectives.
- **Document Asset Inventory and Condition:** Perform periodic condition assessment of assets and determine actual performance as related to the LOS.
- **Plan/Analyze:** Perform planning tasks that help identify performance shortcomings and, where needed, modify maintenance practices and/or generate capital project scopes that eliminate the performance gaps and prioritize work.
- **Develop Budget:** Review cost estimates of new or modified work, compare to the existing budget, and prepare revised budgets for decision makers' review. In parallel, SFPUC Finance staff help prioritize and structure the budget (including the CIP) by providing financing options and limitations.
- **Implement/Operate:** Carry out maintenance programs, as adjusted, and complete any capital projects.
- **Obtain/Apply Feedback:** Record available data for use in informing planning and budgeting.

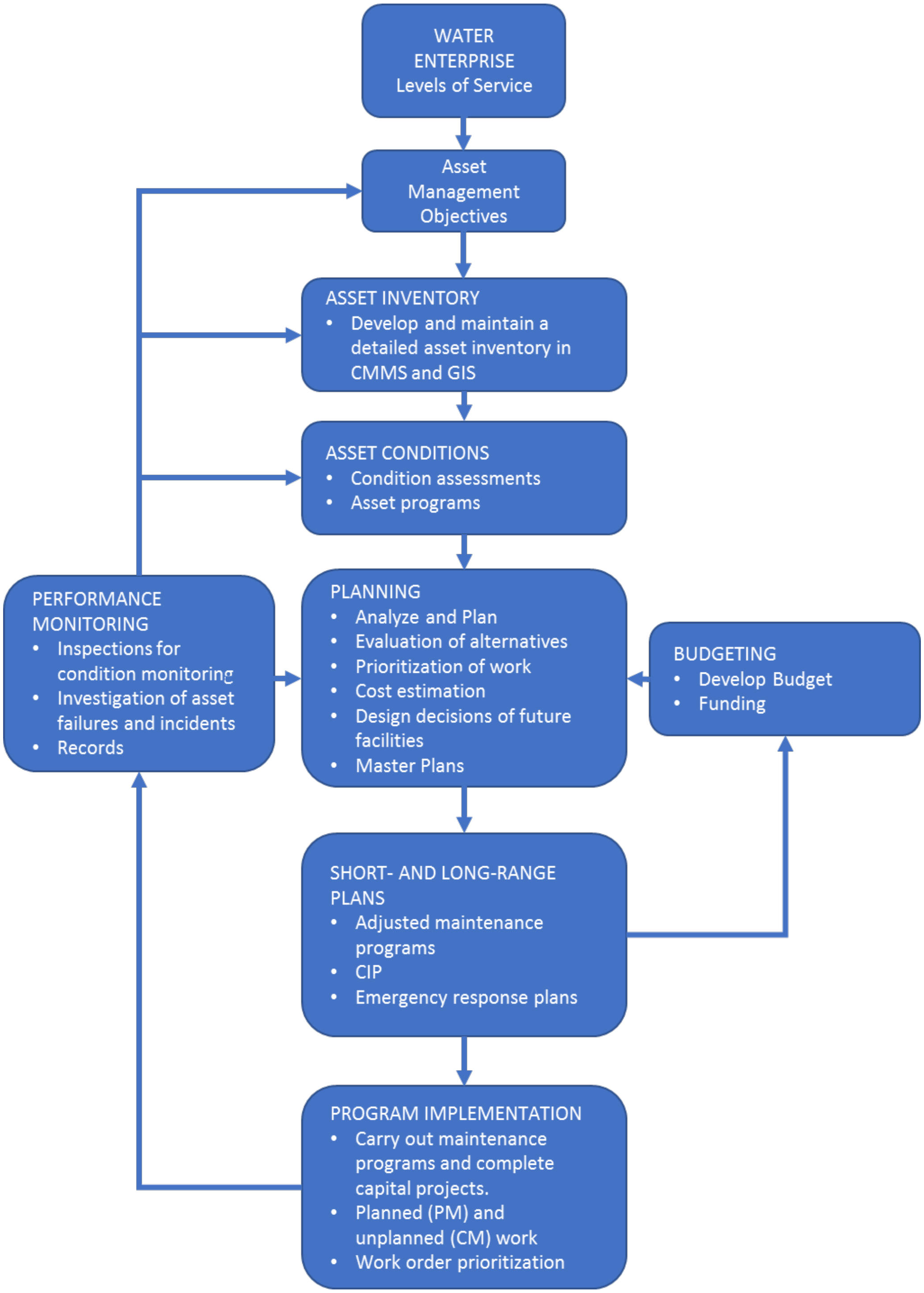
The diagram presented in Figure 3-1 applies to both HHWP and WSTD and illustrates how these functions should work together.

3.1 Performance Objectives

As a general matter, a utility's LOS represents broad, system-wide performance objectives that guide the management of the utility and that can be communicated and understood by ratepayers. LOS can evolve over time, reflecting changes to regulatory requirements, system demands, adoption of new reliability standards, and the willingness of ratepayers to pay.

Overall, the performance of the system is the collective performance of the system's individual assets. The challenge then becomes creating an asset management program for individual assets that ensures that broad system-wide performance is achieved—and doing this in a cost-effective manner. Below, the broader policy-level objectives (i.e. LOS) are discussed first (Section 3.1.1), followed by the asset management program objectives (Section 3.1.2) that have been designed to achieve the policy-level objectives.

Figure 3-1: Asset Management Program Processes



3.1.1 Levels of Service for the Regional Water System

In 2008, the SFPUC adopted LOS Goals and Objectives for the Water Enterprise in conjunction with the approval of the WSIP Programmatic Environmental Impact Report. Those LOS provided the basis for many of the WSIP project designs and are presented below.

Proposed updated LOS Goals and Objectives have been developed and were presented to the SFPUC Commission on October 24, 2017, but have not been considered for adoption (see Appendix I). However, the proposed LOS represent guidance that the Water Enterprise is using in day-to-day operations. They do not represent any reduction from the adopted LOS Goals and Objectives, and cover areas that were not included in 2008, such as In-City Delivery Reliability. Also, a number of LOS have been added that relate to our workforce and our role in the communities we serve, consistent with the SFPUC's 2020 Strategic Plan.

The LOS goals (shown in bold italic headings below) and accompanying objectives (shown in the bullets following the headings) address six areas for improvement: water quality, seismic reliability, delivery reliability, water supply, sustainability and cost-effectiveness.

WATER QUALITY – *maintain high water quality*

- Design improvements to meet current and foreseeable future federal and state waterquality requirements.
- Provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filter all other surface water sources.
- Continue to implement watershed protection measures.

SEISMIC RELIABILITY – *reduce vulnerability to earthquakes*

- Design improvements to meet current seismic standards.
- Deliver basic service to the three regions in the service area (East/South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. Basic service is defined as average winter-month usage, and the performance objective for the regional system is 229 million gallons per day (mgd). The performance objective is to provide delivery to at least 70 percent of the turnouts (i.e., water diversion connecting points from the regional system to customers) in each region, with 104, 44, and 81 mgd delivered to the East/South Bay, Peninsula, and San Francisco regions, respectively.
- Restore facilities to meet average-day demand of 300 mgd within 30 days after a major earthquake.

DELIVERY RELIABILITY – *increase delivery reliability and improve the ability to maintain the system*

- Provide operational flexibility to allow planned maintenance shutdown of individual facilities without interrupting customer service.

- Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages.
- Provide operational flexibility and system capacity to replenish local reservoirs as needed.
- Meet the estimated average annual demand of up to 300 mgd under the conditions of one planned shutdown of a major facility for maintenance concurrent with one unplanned facility outage due to a natural disaster, emergency, or facility failure/upset.

WATER SUPPLY – ***meet customer water needs in nondrought and drought periods***

- Meet average annual water demand of 265 mgd from the SFPUC watersheds for retail and wholesale customers during nondrought years for system demands through 2018.
- Meet dry-year delivery needs through 2018 while limiting rationing to a maximum 20 percent system-wide reduction in water service during extended droughts.
- Diversify water supply options during nondrought and drought periods.
- Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers.

SUSTAINABILITY – ***enhance sustainability in all system activities***

- Manage natural resources and physical systems to protect watershed ecosystems.
- Meet, at a minimum, all current and anticipated legal requirements for protection of fish and wildlife habitat.
- Manage natural resources and physical systems to protect public health and safety

COST-EFFECTIVENESS – ***achieve a cost-effective, fully operational system***

- Ensure cost-effective use of funds.
- Maintain gravity-driven system.
- Implement regular inspection and maintenance program for all facilities.

3.1.2 Asset Management Objectives

As mentioned above, a more specific set of objectives is used to guide capital and maintenance planning and is referred to collectively as asset management objectives. The asset management objectives provide the necessary detail to connect daily workforce priorities with the broader ratepayer service expectations (i.e., LOS). Table 3-1 lists these objectives and provides a status on each.

Table 3-1: Asset Management Objectives

Objective	WSTD	HHWP
Develop and maintain a detailed asset inventory	Roughly 13,000 assets of an estimated 30,000 asset inventory has been set up in detail in our CMMS (Maximo)	All assets where maintenance is performed is included in our CMMS (Maximo). This includes about 15,000 assets
Regularly complete asset condition assessments	Plants were systematically walked through once, over a 3 year period; since then (2011) we have relied upon observations of plant operations staff. Dam, pipelines and right of way assessments are performed regularly. Our buildings and grounds are not systematically assessed.	HHWP performs condition assessment by facility (an aggregation of assets at the facility level). There is a backlog due to funding, facility availability for assessment and staff resources.
Use a computerized maintenance management system (CMMS) to centralize all asset data	Maximo	Maximo
Perform preventive[2] and predictive[3] maintenance to reduce corrective maintenance (CM) and unplanned outages where cost-effective (minimize life-cycle cost), or when system risks to unplanned outages warrant increased maintenance costs	A significant level of preventive maintenance is performed in line with this objective, though no analysis confirming reduction of corrective maintenance or impact on life-cycle cost has been performed.	The program includes preventative maintenance (consistent with industry standards) and predictive maintenance to prevent unplanned outages or risk to operations is high. We do not perform reliability centered maintenance.
Prioritize CM[4] to increase system reliability	Noting first that a higher objective is to reduce CM, yes, operational risk is a primary driver in how we prioritize	In 2018, a reliability process was developed to address failures and determine root cause. The process has not

[2] Preventive maintenance involves regularly performed, planned tasks that are scheduled based on either time passed or meter triggers. This is done to reduce the possibility of asset failure.

[3] Predictive maintenance relies on conducting maintenance based on trends within equipment data. This technology is tied to condition-based monitoring systems for reading the output (condition) of an asset's variables. Predictive maintenance is based on predicting when an asset needs attention rather than simply replacing a part when it could have lasted longer.

[4] Corrective maintenance is maintenance which is carried out after failure detection, and is aimed at restoring an asset to a condition in which it can perform its intended function.

Objective	WSTD	HHWP
	CM at our plants, along with staff safety.	been implemented as of this date.
Complete peer review of maintenance programs to ensure that the scope of maintenance is consistent with industry standards	In 2016 a peer review was performed to identify the maintenance program needs with respect to coming up to industry standards.	Not all assets in Maximo have gone through peer review. PMs were originally developed by HHWP Maintenance Engineering and Operations and are consistent with industry standards. Modifications to PMs can be recommended by either Operations or Maintenance Engineering. Modifications are reviewed by Maintenance Engineering.
Develop expenditure reports that compile costs for facilities, assets, and maintenance programs—a quick way to tell where money is going and what it is accomplishing.	Expenditure reporting at the facility level has been established as an objective for staff to implement in FY19.	We have collected the information but have not set up reports.
Update the 10-year CIP and annual operating budget by integrating data from condition assessments, estimates of remaining useful life, failure analyses, replacement costs, maintenance programs, and LOS into a well-informed forecast of capital and R&R costs.	Information from conditions assessments has been used in the updating of the current 10-year CIP.	Conditions are not performed by asset but by facility. In 2017, HHWP began the process of developing an Asset Risk tool to evaluate criticality, likelihood of failure and consequence of failure for facilities and linear systems. The tool includes replacement costs and LOS are included in the criticality rating.
Investigate asset failures and document the root cause of failure	Documentation and investigation of major systems failures and some asset failures is routinely performed.	HHWP has developed a reliability process to address failures and determine root cause. The process has not been implemented as of this date.
Plan facility maintenance to minimize risk to customers	Focused planning of preparation for high production periods is performed regularly to reduce customer risks during Hetch	Asset Risk Tool in development

Objective	WSTD	HHWP
	Hetchy source outages.	
Maintain emergency response plans (listed in Appendix B)	Regular updates and training on plant risk management plans are performed; Dam emergency action plans are exercised and updated.	Yes. Out of the seven plans that are listed in Appendix B, we have either reviewed or updated the plans, if needed, since 2016.
Design future facilities based on information gathered through the asset management program.	This is an ideal we are working toward by pushing for capital project design services to include O&M engineering provisions.	Yes

These asset management objectives become even more critical for the RWS now that most of the WSIP assets are complete and in need of an appropriate maintenance program.

3.2 Asset Inventory

The objective of the Asset Inventory is to develop and maintain an accurate inventory and recording system for the multitude of assets in the RWS. This process involves several databases which house the asset inventory, condition, performance history, and location. Three primary databases support asset management processes: the CMMS (MAXIMO), the Fixed-Asset Accounting System (FAACS), and the geographic information system (GIS).

3.2.1 CMMS (MAXIMO)

A primary function of the CMMS is as a work order system that records and schedules maintenance and operations support by trades staff and engineers. Increasingly, though, the CMMS is being used to support asset management and capital planning, because it contains asset condition, performance history, and cost of maintenance. Improving the linkage between capital projects and the CMMS is ongoing. Ideally, engineering drawings showing equipment and assets would be automatically added to the CMMS once project closeout is complete and installed equipment is verified.

The CMMS allows thousands of pieces of equipment over seven counties to be compiled in a simple, searchable inventory. The CMMS includes complete descriptions of each asset, along with installation dates and performance histories; most assets are also geolocated in CMMS and GIS.

Along with regular standardized assessments, asset condition is also supplemented by maintenance reports and operator observations. Asset information is aggregated up to the facility level. Aggregated information provides management with actual performance of individual assets and larger facilities, and remaining useful life. The CMMS contains labor and materials expenditure data that permit accurate estimation of asset value and replacement costs. A process to ensure quality assurance of CMMS data is still under development but there is no timeline for completion.

3.2.2 Geographic Information System

The GIS program used by WSTD provides GIS support to mission-critical core programs such as Pipeline Inspection, Underground Service Alert, and Emergency Response. GIS has also been identified as a key component of succession planning, due to its ability to record information about assets and store this information where it can be intuitively retrieved by new employees.

Information about assets is recorded in various GIS libraries, including pipeline alignments, property rights and boundaries, and appurtenance locations (valves, vaults, manholes, service connections, etc.). GIS also records peripheral data such as leak history; and geotechnical data, including liquefaction potential, corrosion potential, and locations of known earthquake faults. Links in the GIS data also reference engineering drawings (plans and profile as-builts).

Multiple web-based mapping applications have been created to view the GIS data. These web applications can be securely viewed on desktop computers, laptops, phones, and tablets, both onsite and off. WSTD has created cloud-based web applications specifically dedicated to emergency response. These cloud-based applications offer far greater reliability and accessibility in the event of a natural disaster.

WSTD is working toward integrating CMMS with the GIS system. This will allow geographic data for assets to be directly available in the CMMS. There are also numerous GIS-based displays that can be used to view work orders geographically in the office or on mobile devices in the field.

To integrate these systems, both must have data that accurately reflect the assets on the ground and are named according to the asset classification index used in the CMMS. WSTD is currently creating GIS data by using site surveys that inventory assets. Once the GIS data accurately reflect the assets, the CMMS will be updated using the GIS data, and the two systems will be integrated. The overall schedule is to finish in about 4 years or 2023. It is the data acquisition part of the project that controls the timeline. Field crews are currently scheduled to complete field assessments in February of 2022. After that, data will be input into GIS and then Maximo within 6 months. The majority of the data collection is being performed by the Regional Cross Connection Controls Project (this project is discussed in Section 4.2.5). The first batch of data, BDPL Nos. 3 and 4, is being used to configure and test the system integration in FY19.

3.2.3 Fixed-Asset Accounting System

The FAACS was used to compute the value of a facility or fixed asset net of depreciation. This was the primary database used for the SFPUC’s financial statements. The new PeopleSoft Financials and Procurement system went live on July 3, 2017 as the new financial system of record of the CCSF, and is used to develop and publish SFPUC’s financial statements. When capital projects are completed, project managers communicate facility and asset details to SFPUC Financial Services staff. PeopleSoft is used to compute the value of a facility or fixed asset, net of depreciation.

Depreciation begins at substantial completion using the straight-line method over the estimated use lives of related assets, which range from 1 to 100 years for equipment, and 1 to 200 years for buildings, structures, and improvements. The computerized maintenance management system, Maximo, has been interfaced with PeopleSoft utilizing the same project cost structure to better align project and maintenance expenditures with fixed assets. The SFPUC will continue to collaborate with the CCSF Controller's Office to plan future enhancements for asset management functionality within the PeopleSoft system.

3.3 Condition Assessments

The assets in the RWS are periodically inspected through three separate assessment programs, each essentially using a risk-based approach: 1) fixed assets, 2) linear assets, and 3) dams.

The first program addresses fixed assets. Facility inspections are prioritized and repeated every 3 to 10 years, depending on each facility's importance in meeting LOS. WSTD uses three tiers of classification for facilities in the Bay Area, with Tier 1 representing the most important classification. There are about 100 facilities in the three tiers. Although inspections are performed at the facility level, condition data in the CMMS are recorded at the asset level. At HHWP, condition assessments on critical assets with a life expectancy of greater than 25 to 30 years are performed on a case-by-case basis. Early in the asset's life cycle, inspections and limited assessments coincide with scheduled maintenance activities. As assets move through their life cycle, the information gathered from previous preventative maintenance reports as well as from performance deviations identified by operators is used to schedule more comprehensive condition assessments. For critical assets with a lesser life expectancy, assessments are built into the asset's routine preventative maintenance program.

Linear assets (e.g., pipelines and roads) are assessed with a second program. Inspection frequency is dictated by pipeline conditions, ability to shut down the pipeline (usually the pipelines must be drained), operational problems associated with pipeline failures, potential liabilities, and the rate of degradation observed in prior inspections.

Dams use a third inspection and monitoring program, usually performed with regulatory oversight. The program is conservative, considering the high liability associated with dams, and the importance to the region's water supply. The major components of the program consist of: regular inspection and monitoring, regulatory reporting, maintenance, repairs, planning studies (stability studies, inundation map updates, and other), and emergency planning.

For all three condition assessment programs, a risk-based approach recognizes two key components: consequence of failure and probability of failure. The risk of failure is the consequence of failure combined with the probability of failure (risk = consequence × probability).

- **Consequence of failure:** severity of impact of the failure on the RWS should the asset fail. Consequences of an asset's failure will impact the RWS LOS described above.

- **Probability of failure:** likelihood that failure arising from any deficiencies will occur.

An asset's failure will impact LOS, but criticality criteria need to be defined to assess the impact of failure that an asset has on RWS and the defined LOS. The following criticality criteria are used to quantify the overall consequence of failure of an asset.

- **Water delivery:** insufficient water quantity (including interruption in water supply) and loss of fire suppression capabilities.

- **Drinking water quality:** degradation of water quality, which could result in loss of life and detrimental effects on human health.
- **Environmental:** harmful discharge to air, land, or water caused by human or mechanical failure.
- **Safety:** impacting the safety of the public or SFPUC staff.
- **Public perception:** damage to the SFPUC's reputation and the loss of consumer confidence in the SFPUC's ability to provide reliable and safe drinking water.
- **Financial:** loss of revenue if supplies cannot be made, increased expenses if regulatory fines are levied.

In general, facilities are deemed high risk when there is a relatively high probability of failure, and failure would lead to major operational consequences based on the criticality criteria defined above (i.e., loss of water supply and/or failure to meet water quality objectives). For condition assessment priority, it is important to note that this assignment of risk occurs at the facility level (such as HTWTP). Actual maintenance, which is performed on the individual assets in a facility, is prioritized using a method like the one discussed in the following section. Prior and next assessments at RWS facilities, linear assets, and dams are listed in Appendix C.

3.3.1 Facility Assessment Program

Formal assessment of most facilities began about 20 years ago, when the scoping process for the WSIP began. Most WSTD Tier 1 facilities were revisited in 2009, with assessments of Tier 2 facilities following in 2010. After these first rounds were completed, subsequent inspections were scheduled on a repeatable cycle. Many Tier 1/critical facilities were significantly modified by capital projects, which created challenges for capturing an accurate asset inventory. Although improving every year, many facilities still have incomplete inventory of assets in Maximo. A few critical facilties are well documented with about 95 percent of the assets in Maximo. Appendix C details the condition assessment priorities for facilities, dams, and linear assets.

For consistency and efficiency, all assets in a facility, such as a pump station or treatment plant, are assessed at the same time. Facilities completed under the WSIP have been be added to the appropriate condition assessment schedules. In some circumstances (e.g., specialized coatings and liners), assets must be inspected within the applicable warranty period, often 1 to 2 years after substantial completion. Tunnel inspection is particularly difficult and hazardous due to the presence of potentially explosive gas in many SFPUC tunnels. Despite these challenges, the SFPUC has been able to inspect four major tunnels in recent years (Crystal Springs By-Pass Tunnel, 2011; Mountain Tunnel, 2008 and 2017; CRT, 2015; and Irvington Tunnel No. 1, 2015).

Pre-Assessment Planning

Prior to conducting condition assessments, all records of maintenance performed since the previous assessment are reviewed by Maintenance Engineering staff. This includes, but is not limited to: CM logs, preventative maintenance logs, O&M manuals, standard equipment templates, relevant installation or as-built drawings, and relevant equipment specifications or technical data sheets. Capital project deliverables (equipment lists, data sheets, and O&M manuals) are verified with existing CMMS data and onsite conditions.

If equipment requires an unusually high level of maintenance or displays unusually poor performance (compared to manufacturer's specifications and recommendations), Maintenance Engineering staff determines whether equipment is properly specified, engineering processes are appropriately designed, and equipment is installed properly. Maintenance Engineering then makes improvement recommendations to the facility manager, as appropriate.

Field Assessment

Assets are assessed in the field using standard asset condition assessment forms unique to the asset category (e.g., mechanical, electrical, structural, or linear). The facility assessment team consists of an operator, a facility manager,[5] a maintenance planner, a maintenance engineer, and any specialty tradesperson. For each assessed facility asset, the assessment team verifies that all asset details have been recorded on the equipment form. For each asset, the asset name, location, brief description, CMMS identification code, and date placed in service are recorded on the standard asset condition assessment form. If any information is missing, that is also noted.

Each assessed asset is visually inspected to observe its general condition. This observation is categorized using a numerical scale, and described on the forms. Equipment is also observed in operation, to the extent possible, and field observations or observed failures are recorded on the asset condition assessment forms. Corrective actions or remedies are identified and recorded.

Other recorded details include inspection date, assessment team, date of next inspection, time to complete the assessment, and estimated remaining useful life. Digital photos are taken of the asset, as required.

Post-Assessment Analysis

Following completion of all assets in a tier, Maintenance Engineering reviews data collected during the assessments, design records, and maintenance history records, and then completes a condition assessment report. Maintenance Engineering determines whether the process engineering is adequately designed and whether the equipment was properly specified and installed. The report also recommends improvements to maintenance or equipment upgrades/ respecification; new process engineering, if warranted; and parts/materials lists for essential spare parts. The goal of the report is to provide actionable recommendations to management that will lower life-cycle costs and reduce unplanned outages.

3.3.2 Linear Asset Program

The linear assets of the RWS include pipelines, tunnels, and penstocks, as well as watershed roads. This section primarily addresses pipeline inspections, which are usually performed inside a dewatered pipeline. The SFPUC continues to perform pipeline inspections to

[5] Staff leads for facilities vary; typically, chief stationary engineers manage treatment facilities and pump stations, plumber supervisors manage pipelines and vaults, and building superintendents manage buildings and corporation yards.

proactively find potential problems with transmission pipelines before major problems occur; as with facility condition assessments, pipeline inspections are risk-based.

Pipeline inspections are scheduled through a four-step process. First, a long-range recurrence inspection schedule is created based on date of the last inspection and the pipeline material. Second, criticality of the pipeline is considered, particularly if a segment of pipe will be relied upon with no redundancy during other outages. Third, the condition of the pipe found on the previous inspection is considered. Last, schedules are adjusted by up to 2 years (sooner or later) to accommodate construction and other system outages that can affect the cost of performing the shutdown and inspection. If a pipeline is particularly critical, cost is a minor factor.

The pipeline inspection program in the Bay Area began in 1990, with the dedication of two engineers to the task. During the early 1990s, utility plumbing crews were expanded to prepare pipelines for interior inspections, support inspections, and replace any inoperable appurtenances. Since the inception of the inspection program at WSTD, 139 miles of the 229 miles pipeline were inspected at least once in the inspection program, and 90 miles of pipeline have never been inspected (30 miles of which is newer pipelines built between 2012 and 2015). HHWP has been performing condition assessments on the SJPLs since 2006 and has inspected more than 42 miles of pipe.

There are a variety of pipeline types and sizes that require specific inspection techniques to detect flaws and assess conditions particular to each pipeline. Each type of flaw requires unique repair methods to restore the pipeline. Some flaws are significant enough, or extensive enough, to warrant replacement or slip-lining.

Most inspections of pipelines use visual methods to detect flaws. The most common category of pipeline is WSP, representing more than half of the total distance of transmission pipelines. Riveted pipelines, the oldest in the transmission system, also make up a significant portion of the total. RCP is also inspected visually, but has flexible joints, a unique feature. Steel "lockbar" pipeline develops flaws similar to those of WSP. A combination of acoustic sounding (with a ball peen hammer) and visual inspections is performed for all pipelines.

Inspections of steel pipe sections of the SJPL are performed with a HHWP inspection device.[6] The device identifies areas of thin wall that require repair and/or replacement of long sections of pipe with significant corrosion. Spot repairs guided by such inspection data are one of the best options to extend the life of the asset at the least cost.

Due to the liabilities associated with PCCP and the prevalence of this pipe in other water systems across the world, special technologies have been developed to inspect and detect the unique flaws that can develop in PCCP. An electromagnetic device is towed through a dewatered pipeline section by a specialized contractor to determine the number of broken prestressed wires that surround the pipeline (when intact, these wires provide most of the hoop strength). A baseline of current wire breaks is typically established for each pipe section using prior inspection data or a calibration section of pipeline of known condition (if available). Then

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[6] More information on the HHWP inspection tool is available at this link: Advanced Method of Condition Assessment for Large-Diameter Mortar-Lined Steel Pipelines. https://infrastructure.sfwater.org/fds/fds.aspx?lib=HHWP&doc=210945&data=65603895

additional wire breaks can be detected/monitored through real-time monitoring using acoustic fiber optic cable inserted into the pipeline (while it is in service), or by additional inspections.

These proven methods have been used throughout the industry for more than 10 years and are reliable. Details of linear asset condition and inspection techniques are included in Appendix D and Appendix E.

The valve exercise program is designed to extend the useful life of valves, increase reliability, and reduce life-cycle costs. The valve exercise program is based on specifications outlined in the valve manufacturer's O&M Manual, as well as best management practices (BMPs). See Section 4.2.3 for a description of the transmission valve exercise program.

3.3.3 Dam Assessment Program

The SFPUC owns and operates 22 dams that are part of the RWS, of which 15 dams—including 11 regional dams outside San Francisco and four dams in San Francisco—are under the jurisdiction of the California DSOD (Table 3-2). The RWS includes the six dams under DSOD jurisdiction in Tuolumne County (Early Intake Dam, Lake Eleanor Dam, Moccasin Dam (aka Lower Moccasin Dam),[7] O'Shaughnessy Dam, Priest Dam, and Cherry Valley Dam); two in Alameda County (Calaveras Dam and Turner Dam); three in San Mateo County (San Andreas, Pilarcitos, and Lower Crystal Springs); and four in San Francisco County (University Mound [North and South] and Sunset Reservoir [North and South]). This report does not cover the other dams in San Francisco County that are not part of the RWS and serve only local residents in San Francisco. In addition, the SFPUC owns, operates, and maintains several smaller dams in the RWS that are not under the jurisdiction of the DSOD (see Table A-1 in Appendix A for the full list of RWS dams).

As shown in Table 3-2, each dam receives a hazard classification from the DSOD with respect to dam safety. This classification is based solely on downstream hazard considerations in the unlikely event of dam failure resulting in an uncontrolled release of water, not the actual condition of the dam or its critical appurtenant structures. The downstream hazard is based solely on potential downstream impacts to life and property should the dam fail when operating with a full reservoir. This hazard is not related to the condition of the dam or its appurtenant structures.

- Low - No probable loss of human life and low economic and environmental losses. Losses are expected to be principally limited to the owner's property.
- Significant - No probable loss of human life but can cause economic loss, environmental damage, impacts to critical facilities, or other significant impacts.
- High - Expected to cause loss of at least one human life.
- Extremely high - Expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more.

[7] Moccasin Upper Dam is an appurtenance of Moccasin Dam.

Table 3-2: DSOD Jurisdictional Dams in the Regional Water System

Dam	County	Year Built	Reservoir Vol. (AF)	Downstream Hazard Class	EAP in Place	Inundation Maps Due	Evaluations Underway	DSOD Condition Assessment
Calaveras	Alameda	1925	96,800	Extremely High	Yes	1-Jan-18		(in construction)
James H. Turner	Alameda	1964	50,500	Extremely High	Yes	1-Jan-18	Spillway	Fair
Lower Crystal Springs	San Mateo	1888	69,300	Extremely High	Yes	1-Jan-18		Satisfactory
Pilarcitos	San Mateo	1866	3,100	High	Yes	1-Jan-19		Satisfactory
San Andreas	San Mateo	1870	19,027	High	Yes	1-Jan-19	Spillway	Satisfactory
O'Shaughnessy	Tuolumne	1923/38	360,360	Extremely High	Yes	1-Jan-18	Spillway	Satisfactory
Cherry Valley	Tuolumne	1956	273,500	Extremely High	Yes	1-Jan-18	Spillway	Satisfactory
Early Intake	Tuolumne	1925	115	Low	Yes	Not Required		Fair
Lake Eleanor	Tuolumne	1918	27,113	High	Yes	1-Jan-19		Satisfactory
Moccasin	Tuolumne	1930	554	High	Yes	1-Jan-19	Spillway, Dam	Poor
Priest	Tuolumne	1923	1,706	High	Yes	1-Jan-19		Satisfactory
Sunset North Basin	San Francisco	1938	274	Extremely High	Yes	1-Jan-18		Satisfactory
Sunset South Basin	San Francisco	1960	268	Extremely High	Yes	1-Jan-18		Satisfactory
University Mound North Basin	San Francisco	1885	182	Extremely High	Yes	1-Jan-18		Satisfactory
University Mound South Basin	San Francisco	1937	249	Extremely High	Yes	1-Jan-18		Satisfactory

Notes:

Downstream Hazard Classification: (classification is based solely on downstream hazard considerations, not the actual condition of the dam or appurtenant structures.):

Low – No probable loss of human life and low economic and environmental losses. Losses are expected to be principally limited to the owner's property.

Significant – No probable loss of human life but can cause economic loss, environmental damage, impacts to critical facilities, or other significant impacts.

High – Expected to cause loss of at least one human life.

Extremely High – Expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more.

Definitions of downstream hazard classification and DSOD condition assessment can be found at https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/All-Programs/Division-of-safety-of-dams/Files/Publications/DSOD-Dam-Rating-Information-and-FAQs.pdf

AF = acre-feet
CIP = Capital Improvement Program
DSOD = Division of Safety of Dams
EAP = Emergency Action Plan
WSIP = Water System Improvement Program

Of the nine jurisdictional dams in the Bay Area, Lower Crystal Springs is a concrete gravity arch dam; the other eight (Calaveras, Turner, San Andreas, Pilarcitos, University Mound North and South, and Sunset North and South) are earth embankment dams. See Appendix A for additional detail.

The system also includes several other smaller, nonjurisdictional dams. UCSR is relatively large in terms of storage volume by comparison to the others, but only impounds water 3 to 10 feet above the adjacent LCSR.

Dam Safety Program

HHWP, WSTD, and City Distribution Division (CDD) implement ongoing comprehensive dam safety programs to monitor, inspect, and maintain the dams to ensure public safety downstream. HHWP updated its Dam Safety Program in 2014. In FY18, WSTD updated its Dam Safety Program, which extends beyond the minimum requirements of the DSOD, outlined in the California Water Code, Division 3 – Dams and Reservoirs.

This extensive program establishes policies, objectives, and expectations as they relate to dam safety, including a surveillance and monitoring program. The SFPUC has adopted the following long-term commitments as they relate to the operation of their six dams.

- The dams and appurtenant structures will be operated in a manner that keeps them operationally and structurally safe.
- The dams will be maintained in a safe and nondefective condition to prevent degradation of the dam and appurtenant structures, and to maintain serviceability.
- The dams will be subjected to regular preventive and CM activities, jointly implemented by Maintenance Engineering and O&M staff for HHWP and WSTD. Dam maintenance records will be maintained by the Maintenance Engineering Staff. Example preventive and CM activities include crack repairs, vegetation and rodent control, ground repairs, instrumentation repairs, and valve and electrical system repairs.
- Nonroutine, specialized, and large -scale dam maintenance work and studies will be addressed by the Division's CIP. They will be designed by consulting engineers and will include projects such as instrumentation upgrades, and dam, spillway, or outlet retrofits. Planning projects may include studies such as seismic stability evaluations, inundation map updates, and emergency planning.
- Routine surveillance, monitoring, and reporting of the dam conditions will be performed in accordance with the surveillance and monitoring program. These activities include regular engineering inspection and analysis; reporting of instrumentation readings and measurements, such as piezometer, seepage, rain gage, and reservoir level readings; and engineering surveys of the dams for differential movement.
- The dams will be inspected once a year by staff from Engineering and Surveying, Dam Safety Program and other Division personnel and/or consultants, as deemed necessary or prescribed by the protocols specific to each Water Enterprise Division. DSOD personnel will be invited to participate in these inspections. The results of the annual inspections will be

documented in the Dam Inspection or Surveillance and Monitoring Report, and submitted by Engineering staff for management review in accordance with Division procedures. A copy of the Dam Inspection or Surveillance and Monitoring Report will be sent to the DSOD upon completion of this review.

- The valve exercising program requires the SFPUC to operate the adit valves and emergency release valves for each dam once per year. Every 3 to 5 years, DSOD inspectors, along with the Division engineer and inspector, will need to witness the valve exercising for each dam. A wet test with all the valves opened all the way is preferred. When environmental restrictions prevent the full release of water downstream (as was the case for Turner Dam for many years before 2018), a dry test will be done by opening and closing the emergency release valves with the adit valves closed (thus not allowing any water to go downstream). After testing, the emergency release valve is then closed and the adit valves are opened and closed.
- WSTD participates in the Bay Area Dam Owners Group (a local collaborative effort with SCVWD, Contra Costa Water District, and EBMUD), including peer review and information sharing on topics such as dam safety and monitoring, environmental permits for dam maintenance, emergency preparedness, seismic stability analyses, and operational restrictions.

3.4 Planning

Identifying any shortcomings between desired performance and actual performance, and then determining how to close the gaps with capital projects, modified maintenance, or enhanced staff training is the primary function of the planning process. A well-designed planning process involves thorough research, broad involvement by staff and stakeholders, and documentation of assumptions and decisions. As discussed above, knowledge of asset condition is paramount to this process.

3.4.1 Develop and Review Maintenance Programs

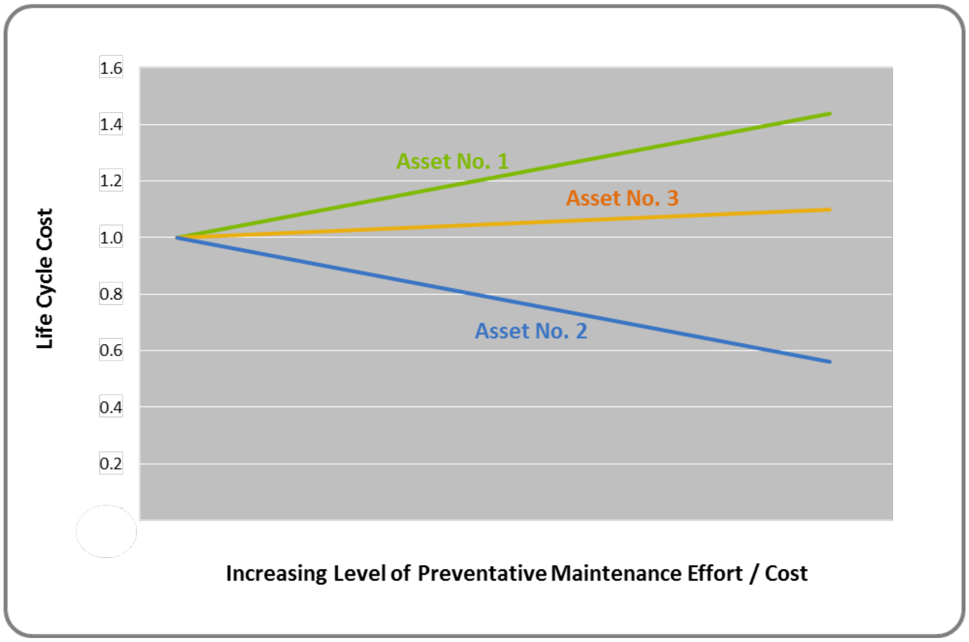
Maintenance procedures for assets originate from manufacturer documentation that is usually delivered at the time of asset acceptance (either delivery sign-off or during project closeout). A capital project can typically generate hundreds of new assets and procedures. Tracking to ensure delivery of this information is a separate effort, and is discussed below.

These procedures must be translated into “job plans” that outline the specific sequence of maintenance tasks, the frequency and timing of the procedures, and which work crews must work together to complete the tasks. These translation and set-up functions are performed by maintenance planners, and a maintenance engineer confirms the technical aspects of the maintenance tasks.

In 2015, WSTD began using external maintenance experts to review the job plan for Baden Pump Station to ensure that appropriate maintenance was being performed and documented. This peer review ensured that the scope of maintenance was understood and appropriately prioritized. Reports are also reformatted into easier-to-read summaries that can be quickly generated from the work order database. These reports allow managers to track how often and how thoroughly maintenance is being performed at a facility, compared to objective industry standards. Such standards may ask whether the appropriate critical work tasks are being completed; identify how work is currently being documented; identify how accomplished work is being reported; determine whether the maintenance team is appropriately staffed. The review effort was initiated at the Baden Pump Station and is now focused on the SVCF. The review also concluded that typical industry standard has a ratio of one planner to 30 staff. WSTD's planner to staff ratio is 1:60. HHWP is currently not using these tools.

The decision on whether and/or when to perform preventive maintenance (PM) is based on two objectives: to minimize unplanned outages (reliability) and to minimize life-cycle costs. For a given level of reliability, higher levels of PM can result in different life-cycle cost scenarios, depending on the asset. This is illustrated by the three hypothetical examples on Figure 3-2.

Figure 3-2: Preventive Maintenance Prioritization Methodology



For hypothetical Asset No. 1, increasing PM activities increasingly adds to the overall life-cycle cost due to its low replacement value. The maintenance strategy employed in this case should appropriately be "run to fail" (assuming reliability is unaffected). Examples include off-the-shelf electronics and sensors, as well as inexpensive pumps or motors that require little or no PM.

For Asset No. 2, increasing PM activities continues to lower the overall life-cycle cost, a typical result for large-value assets. Investment in corrosion protection is an excellent justification for paying higher PM costs to reduce overall life-cycle costs. Without proper corrosion protection—which could cost as little as $10,000 a year—a $100-million pipeline can have its useful life reduced by 50 percent.

For Asset No. 3, increasing PM activities slightly increases overall life-cycle costs. Although the goal of any PM program is to lower overall life-cycle costs, the role of certain assets in water system reliability (or any part of LOS) may warrant deviation from this goal. If high operational consequences result when a chlorine injection pump that has little redundancy experiences an unplanned outage, the higher life-cycle costs attributed to maintenance (assuming that the maintenance is effective at increasing useable life and/or reliability) may be warranted to reduce system risk. Also note that in general, when maintenance is not cost-effective, system reliability can still be addressed by adopting a maintenance plan that essentially consists of predicting the component's remaining useful life and then replacing it when it reaches 85 to 95 percent of that value. Many systems in the RWS in contact with corrosive chemicals fall into this category.

3.4.2 Compile Performance and Failure Reports

Equipment and asset failure reporting is a critical function of asset management. Incidents that occurred in FY17 and FY18 did not disrupt water service to customers. These incidents included: chemical leaks/overfeeds in the Sunol Valley region, UV lamp breaks/lamp failures at the TTF, various equipment failures throughout the RWS, communication issues between facilities in the East Bay Field, and operator errors. Two of the more significant events were the TTF UV lamp failures and lamp breaks, and SCADA issues that led to off-spec water events. In regard to the TTF UV lamp failures and lamp breaks, WSTD has been closely working with the UV manufacturer to further troubleshoot the incidents to determine the root cause. In addition, a consultant is being hired to evaluate causes outside of just the UV system.

One of the SFPUC's goals during a RWS emergency is passing on the most accurate and current information to the wholesale customers. The SFPUC's primary notification tool is i-INFO, which allows the SFPUC to reach out to the largest group in the least amount of time, and pass along the most current and accurate information available. Where individual customers may be impacted to a greater extent, individual calls are made using the contact information provided by the wholesale customers. As more information becomes available, i-INFO is used to keep customers apprised of significant developments.

A powerful tool to help wholesale customers make decisions is eDna. eDna is the SCADA historian linked to the SCADA network. This information is transmitted in near real time. The critical detention time and water quality data used for notifications and operational decisions is available to the wholesale customers.

Appendix F contains a full list of incidents during the reporting period, along with the root cause of the failure. Corrective actions are documented in individual failure reports. Any of the following circumstances can trigger an incident report: partial or total unplanned outage of a facility (or "near miss"), unplanned discharge to the environment, drinking water quality violation (or anything reportable under the drinking water permit), employee injury (or anything reportable under California OSHA requirements), and chemical spills or leaks that are reportable to regulatory agencies such as Alameda County, San Mateo County, San Joaquin County, and the California Governor's Office of Emergency Services.

Failures from inadequate preventative maintenance can be addressed by reviewing procedures, designating critical equipment in CMMS, ensuring that condition assessments are performed, and periodically reviewing incident reports with all (not just affected) staff.

After an unplanned failure of an asset or facility is reported by operations or detected by SCADA, the SFPUC completes a simple, streamlined Incident Report that records a description, chronology, possible root cause, and suggested corrective action for the incident. Near misses also count as incidents, even though no realizable operations impacts occur. For example, when a redundant chemical feed pump fails and results in use of a backup, no significant operational impact would have been felt, but the failure is still significant. Other opportunities to gather and trend asset/facility failures (even when they do not reach the level of seriousness of an "incident") come from the SFPUC's internal notification system, i-INFO (the SFPUC's emergency notification software), weekly operations meetings, and CM work orders generated by MAXIMO.

The relevant incident details are recorded in the CMMS. Typical root cause of common failures include: inadequate PM, inadequate design, poor specifications, inadequate training for staff, poor procedures, poor communications, and operator error. Sometimes failures fall outside of these categories, or the reason for a failure is unknown. Typical remedies can include: replacement in kind, modified maintenance, modified operations, revised equipment specifications, and/or enhanced monitoring and training. Recording the performance histories in the CMMS allows long-term review for a piece of equipment or facility (all pieces of equipment are parts of larger facilities). Most importantly, a corrective action plan is developed for each incident. Details for FY17 and FY18 incidents for HHWP and WSTD are shown in Appendix F. Since the 2016 State of the Regional Water System Report, the definition of "incidents" has expanded to include regulatory violations. The increased number of reportable incidents has more than doubled due to this change.

3.4.3 Complete Master Plans

An essential planning function is provided through regular updates of master plans. Typically, master plans cover certain facility classes, such as water treatment plants; general reliability areas, like seismic or corrosion protection; or groups of related assets in a specific geographic location, such as the peninsula low-pressure zone. The plans are updated in a staggered schedule, with one or two completed each year to moderate workload and facilitate integration into the CIP. The scope of master plans extends beyond a simple condition assessment that may be conducted for a given facility on a regular 3-year or 5-year cycle. Master plans include broader asset and/or operational options and LOS factors. For example, a condition assessment documents an asset's state of repair and performance and normally generates a corrective work order or review of the PM; a master plan, on the other hand, will consider whether the asset should be repaired, replaced in kind, upgraded, or abandoned if rendered obsolete. Master plans also occur at the facility level, not the asset level, which allows analyses of how groups of assets are functioning together in a given facility (allowing an engineering process review). Master plans also consider broader failure modes, such as seismicity and large-scale facility structural vulnerabilities; and broader planning objectives, such as relation to the adopted LOS. The master plan schedule is an important reference document and is included in the CIP.

Table 3-3 list schedules for the relevant master plans. Appendix C provides schedules of major condition assessments.

Table 3-3: Master Plan/Inspection Schedule – Bay Area

Program	FY Start	FY Completion
Corrosion Protection (completed)[8]	2009	2010
Dam Maintenance Program – Stability Study Update LCSD[9] San Antonio/Turner Dam San Andreas Dam	2012 2018 2018	2014 2019 2019
Peninsula High-Pressure Zone (PPSU)[10, 11, 12]	2014	2015
Communication Systems	2014	2017
Water Storage – Pilarcitos System Improvements	2015	2019
Chemical Feed Systems – SVCF	2016	2019
Peninsula Low-Pressure Zone Pipelines	2016	2017
Irvington Tunnel Nos. 1 and 2 (Existing)[13]	2015	2015
BDPL Nos. 3 and 4[14]	2016	2019
Alameda Siphons, Calaveras Pipeline, San Antonio Pipeline, SABPL	2017	2018
BDPL Nos. 1, 2, and 5 [15, 16]	2017	2018
SVWTP Reliability Upgrade	2020	2021
HTWTP	2019	2020
Vaults, pump stations, chemical systems, storage tanks, field equipment, etc.	*Ongoing 5-year, 7-year, or 10-year condition assessment cycle.*	

Notes:

BDPL = Bay Division Pipeline
FY = fiscal year
HTWTP = Harry Tracy Water Treatment Plant
LCSD = Lower Crystal Springs Dam
PPSU = Peninsula Pipelines Seismic Upgrade
SABPL = San Antonio Backup Pipeline
SVWTP = Sunol Valley Water Treatment Plant
SVCF = Sunol Valley Chloramination Facility

8 Schiff Associates, "*Corrosion Survey for Transmission Pipelines Contract No. CS-904.C*," SFPUC, July 2010.
9 URS report, "*Lower Crystal Springs Dam Structural Evaluation*" (SFPUC, 2013).
10 Related documents include San Francisco Water Alliance, "*Peninsula Improvement Program Final Report*," SFPUC, March 2002.
11 Related documents include San Francisco Water Alliance, "*Peninsula Improvement Program Technical Memo 2, Hydraulic Modeling of Emergency Operations*," SFPUC, November 2001.
12 MWH/Lee report, "*San Andreas Pipeline No. 2 Extension, Conceptual Engineering Report*," SFPUC, June 2015.
13 Related documents include URS Corporation, "*Final Technical Memorandum No. 8-01D (New) Tunnel Hydraulics*," SFPUC CS-820, March 2008 SHOULD BE 2015 report reference.
14 Related documents include URS Corporation, "*Bay Division Pipeline 4 Reaches A and D Condition Assessment*," SFPUC, June 30, 2008.
15 Related documents include Engineering Management Bureau, Water Infrastructure Partners and Project Management Bureau, "*Bay Division Pipeline Reliability Upgrade Phase 2 AAR*," SFPUC, July 2004.
16 Related documents include Engineering Management Bureau, Water Infrastructure Partners and Project Management Bureau, "*Bay Division Pipeline Reliability Upgrade Phase 3 CER*," SFPUC, January 2005.

3.5 Budgeting

Since FY15, the CCSF has adopted a 2-year budget (both operating and capital). The 2-year budget is prepared and adopted during even-numbered FYs and becomes effective for the two succeeding years. The SFPUC's CIP is updated each year to coincide with the annual updates of the CCSF's CIP. Mid-budget cycle adjustments are minimized.

The capital budget process runs parallel with the Water Enterprise's operating budget requests, the 10-year Capital Plan, and the 10-year Financial Plan. During budget preparation, managers must forecast operating expenses for the next two FYs. The task requires anticipation of asset completion and the necessary staff and resources needed to maintain them. This is particularly challenging with new groundwater wells coming on line in FY18 and FY19, which involves phased testing and operation, and specialized staff. On the capital side, more iteration is required between finance staff and operations staff as they work together to complete the CIP. Rate projections, reserve balances, and financing options each affect the size of the CIP, particularly in the first 2 years of the 10-year Plans. The SFPUC has a Budget Steering Committee that guides the schedule and process for budget updates every 2 years. The budget process generally follows the schedule shown in Table 3-4, beginning in odd-numbered FYs and ending in even-numbered FYs.

Table 3-4: Budget Update Schedule

Date	Budget and CIP Milestone
Spring and Summer	The SFPUC Budget Steering Committee meets to discuss budget and CIP development process.
September	The SFPUC Budget Steering Committee distributes Budget Policy and Procedures document to staff.
September	Staff receive a budget instruction memorandum from General Manager; Unifier system available for staff to submit CIP projects.
September and October	Staff submits projects in Unifier, including description of project, justification, impact if the project is not implemented, budget by project phase, proposed schedule, and risk ranking.
October and November	Executives approve potential projects, and Finance begins funding analysis.
November	Budget staff consolidates all budget submittals into proposed operating and capital budget adjustments for review by Executive Team.
December	Executive Team considers project need, financial impact, and staffing considerations to determine final proposed budget and CIP.
January and February	Commission budget workshops and adoption.
End of February	Budget submitted to Mayor/Controller's office.
March and April	Review by Mayor's Budget Analyst, City Capital Planning Committee, and Controller's Office.
May and June	Board of Supervisors budget review and adoption.

Notes:
CIP = Capital Improvement Program
SFPUC = San Francisco Public Utilities Commission

During the fall and before the Commission budget workshops, staff meets with the Bay Area Water Supply and Conservation Agency to review potential projects in the CIP and confirm capital program priorities. Following internal review by senior management, various Commission workshops are held to discuss the budget with staff in January and February. CIP and budget materials are publicly available in advance of the meetings, in accordance with Commission rules. Rate hearings are held later in the spring. The Mayor's office reviews the SFPUC's budget before presenting the citywide budget to the Board of Supervisors. Finally, the Board of Supervisors reviews and ultimately adopts the budget, usually in late June. Each of these reviews can modify aspects of the SFPUC's budget.

3.6 Implementation

The planning process refines and guides maintenance programs and scoping of capital projects. The major maintenance programs are outlined in detail in Section 4, along with their corresponding accomplishments from FY17 and FY18, as well as plans for future work. Maintenance prioritization in a program, and across programs, is discussed above.

3.6.1 Types of Maintenance Performed

All maintenance programs consist of different type of work orders, although most consist of work orders for either preventive or corrective maintenance. A full list of work order type is shown below for reference.

- **Preventive Maintenance:** This refers to work on a specific asset that is interval- or condition-based. Besides traditional PM, PM work orders in the CMMS include diagnostic testing, servicing and overhauls, compliance/regulatory items, and scheduled inspections. Only assets have associated PMs.

- **Corrective Maintenance:** This refers to unplanned failure or reduced performance on a specific asset that is discovered through field observation, condition assessment, report by an operator, SCADA alarm, or customer report.

- **System Operations:** This refers to work directly supporting operations, but not including maintenance-related work.

- **Capital Support (i.e., WSIP):** This refers to maintenance work in direct support of a capital or R&R project. This includes activities such as dewatering/disinfecting pipelines to support construction, performance testing, and attending project meetings.

- **Administration:** This work type is for O&M staff performing indirect work associated with administrative activities, such as completion of timecards (eTime), training, and safety tailgate meetings.

- **Other:** This refers to miscellaneous operational or maintenance work that does not fit the categories indicated above. One example is corporation yard maintenance.

In practice, the fundamental Reliability Centered Maintenance concept is reflected in maintenance efforts in the RWS that are focused on maintaining reliability of critical assets and that strive to be conditions-based. Work is screened through the maintenance planning group (as described below) and reviewed by the O&M Manager to ensure that work on critical assets is prioritized prior to being scheduled and disseminated to maintenance staff.

As described above, work orders are labeled in the CMMS by type, but the planning/ prioritization process uses additional terms to delineate CM work: planned or unplanned (PM and other work order types are usually categorized as planned).

- **Planned work.** Whether corrective, preventative, or another type, a work order is considered to be planned if a job plan is written and reviewed in the CMMS, the normal approval process is followed, all permits are secured, and appropriate notifications occur. Even after an unplanned failure of asset occurs, the corresponding corrective work order could still be planned. Most planned work is routine and regular.

- **Unplanned work.** Work that skips one or more planning steps due to urgency is characterized as unplanned work. Approvals for work scope, timing, use of overtime, and job parameters can be verbal, as directed by management. Work orders in this category are sometimes created after or during the work.

3.6.2 Work Order Prioritization

This section describes the general process used to prioritize work orders for the RWS, with some differences in actual practice between WSTD and HHWP acknowledged. Prioritization by mid-level managers is required due to the volume of work, and the higher level of perspective needed to gauge the importance of potential tasks—including determining when work orders should not be performed, because the work is not cost-effective or because the work would make it impossible to maintain system reliability.

Work Order Approval and Scheduling

Once a work order has been fully developed and has been appropriately cataloged, the work order enters the approval and scheduling phase, where it is reviewed and approved by the Planning Manager. Once approved, staff may charge labor and materials against the work order until it has been closed, cancelled, or completed. Blanket work orders are usually approved at the beginning of the FY.

Blanket work orders cover only three types of work: 1) general tasks to be completed at a treatment facility by operations staff only; 2) indirect administrative work for supervisors; and 3) staff training. This type of work order is entered into the CMMS through the work request or the work order tracking screens. All blanket work orders follow the same general principles as other work orders and can appear as either child or parent work orders. However, blanket work orders are established at the beginning of each FY, and after preliminary review are immediately approved. All blanket work orders remain open throughout the FY but are closed at the end of each FY.

For all nonblanket work orders, maintenance planning staff schedule the work order depending on the priority level assigned, nature of the work, and availability of staff and materials.

Work order approval and scheduling decisions are made based on the same methodology as the condition assessment program, in that work is prioritized according to the operational consequences of reduced performance level or total failure of a piece of equipment. A CM work order may involve in-kind replacement, upgrade, repair, or demolition and site remediation when the asset is no longer needed.

Work Order Priority System

After PM activities are determined to be appropriate, completion priority generally uses the same logic. That is, the first PM activities to be scheduled are those that reduce the most life-cycle cost and those that increase system reliability the most. Predictive maintenance is not currently performed, but a method using the SCADA system is being explored.

Because work orders of all types are generated on a daily basis, a standardized system is used to prioritize work based on the urgency of completion. In the CMMS, each approved work order receives a priority ranking:

(9) Emergency: The existence of an imminent threat to life or limb, an imminent catastrophic threat to the environment, or an imminent threat of catastrophic equipment failure exists **(usually declared by management)**.

(8) Operational Failure: A personal injury, unscheduled shutdown of critical equipment, harm to the environment, or sustained breach of water quality resulting in a Regional Water Quality Control Board or SWRCB DDW violation has occurred, and immediate action must be taken.

(7) Urgent Work: High Probability of Failure. Urgent action needed to prevent Priority 8 or 9 occurrences. These situations are usually found during PM inspections, but may result from general observations while in an area.

(6) Regulatory Compliance PM: Regulated Testing, Maintenance, and Inspection Activities; these work orders will typically emanate from a regulating body such as the Department of Transportation (DOT), the Department of Motor Vehicles (DMV), OSHA, WECC, CPUC, Regional Water Quality Board, or SWRCB. Examples of this type of work might include DOT vehicle inspections, DMV smog testing, protective relay testing and maintenance, or ROW vegetation management inspections.

(5) High Criticality Asset PM: Preventive/Predictive Maintenance on critical assets, support of WSIP or Hetch Hetchy System Improvement Program construction projects, or a limited window of opportunity (such as a shutdown).

(4) Standard PM: Preventive/Predictive Maintenance/Safety/Code Corrections.

(3) Routine Work: Schedulable maintenance repairs, as a result of PM or general observation, regular/routine work, and cottage remodel work.

(2) Low Priority Work: Work that enhances system or mission performance.

(1) Desirable Work: No direct effect on system or mission performance if not done.

Maintenance Backlog Management

The maintenance backlog is defined simply as a combination of work orders that have been submitted and approved, but are awaiting work initiation; and work that has been identified but not yet approved to proceed. Most of the backlog tends to be low-priority work orders that continually fail to get scheduled due to the presence of higher-priority work. Backlog work orders can also consist of deferred PM. Planning staff monitor outstanding work orders and reinitiate priority ones with trades supervisors.

On a weekly basis, all work in the backlog is reviewed for potential scheduling. At WSTD, priority of the work is used first to screen the work that gets scheduled. In each priority group, assuming all things are equal, the "oldest" work order is scheduled first. The remaining work is scheduled according to "age," in descending order, until either the schedule is full or there are no more remaining work orders among that priority group. Any work order older than one FY is cancelled. Meetings among mid-level managers and trades supervisors ensure that priority work remains in the system.

HHWP staff place work requests into a backlog where managers responsible for their specific work groups approve and commit resources to jobs that are to be performed in the upcoming 30 to 45 days. The HHWP's Asset Management Services group plans and schedules maintenance activities for crafts 7 to 14 days in advance to allow for sufficient notification and coordination to occur.

Performance is tracked using metrics that evaluate:

- labor availability;
- actual work performed on Scheduled versus Unscheduled work (1 week in advance); and
- actual work performed on Forecast work (2-week look-ahead).

As schedule success increases, reactive work decreases, demonstrating an improvement in the maintenance and management of HHWP assets.

Hetch Hetchy is always striving for continual improvement in its maintenance program, which is demonstrated by the implementation of a comprehensive work order life cycle. The work order life cycle begins with initiation and continues through review, approval, execution, feedback, closeout, and updating job plans and asset information as appropriate, all of which are documented by standard operating procedures. This process ensures a standardized approach across all work groups that is measurable and encourages staff participation at all levels.

3.6.3 Capital Project Completion and Closeout Reporting

One of the major responsibilities of the SFPUC during the WSIP is to ensure that appropriate asset management deliverables are received by operations staff and archived by project teams and contractors prior to project closeout. These deliverables include complete sets of equipment manuals (also called O&M Manuals), warranty information, record and as-built drawings, equipment inventory sheets, and in some cases specialized trainings, operating permits/ agreements, and service agreements.

Project closeout is an important step in the overall asset management program. When asset management deliverables are received at project closeout, the information is incorporated into the asset management program. For example, asset inventory data such as equipment lists and identifications are incorporated into the CMMS asset register. Manufacturer-recommended PM cycles are used to develop job plans and PM schedules.

WSIP Construction Management Procedures 32 and 33 describe the Contract Closeout and "Record Documents" submittals, respectively. The Contract Closeout procedure outlines the process by which verifications are made for satisfactory completion of contract work. The Record Documents procedure specifies the process by which record information is collected and documented in construction drawings and at completion of projects, and by which final project record documents are produced, certified, and archived. Projects designated as completed (meaning Final Completion) have 3 to 6 months before the project is closed out. During that time, O&M manuals, Equipment Data Sheets, and Record Drawings are collected and compiled.

WSIP closeout deliverables are audited each quarter and reported to the WSIP and Water Enterprise management, with formal reports beginning in FY12. The most recent tracking sheet is included in Appendix G. As shown in Appendix G, outstanding deliverables exist. Accordingly, Water Enterprise staff actively pursue these deliverables with the various WSIP project teams. Obtaining deliverables from the earliest WSIP projects can be costly (and often unbudgeted)—and difficult, because the earliest projects worked off of less-complete specifications in this area. Still, comparing Appendix G from the 2012 version of this report (when the data were first tracked) shows the task to be nearly complete after years of effort.

Warranty periods are also tracked so that operations staff can thoroughly test components and/or inspect them prior to the expiration of contractor or supplier warranties. Advanced planning is required for inspections of interior pipeline linings, because these actions require additional facility shutdowns at the same time as construction-driven shutdowns.

3.7 Ongoing Program Implementation

Going forward, the approach to maintenance is to reduce the CM and move toward more PM and even predictive maintenance. As more PM is implemented, more costly CM should be avoided. Predictive maintenance will be implemented in situations where it can be shown to be cost-effective.

With WSIP construction winding down in FY19, a big initiative in the coming years will be to ensure that asset inventory is accurate (adding new assets, deleting obsolete or replaced assets, and maintaining existing assets). Rehabilitation and upgrade projects occurring at the same facility make this a challenge. Implementing this shift in approach requires acceptance of ownership and associated responsibilities of all new assets constructed and/or installed in the RWS as part of the WSIP.

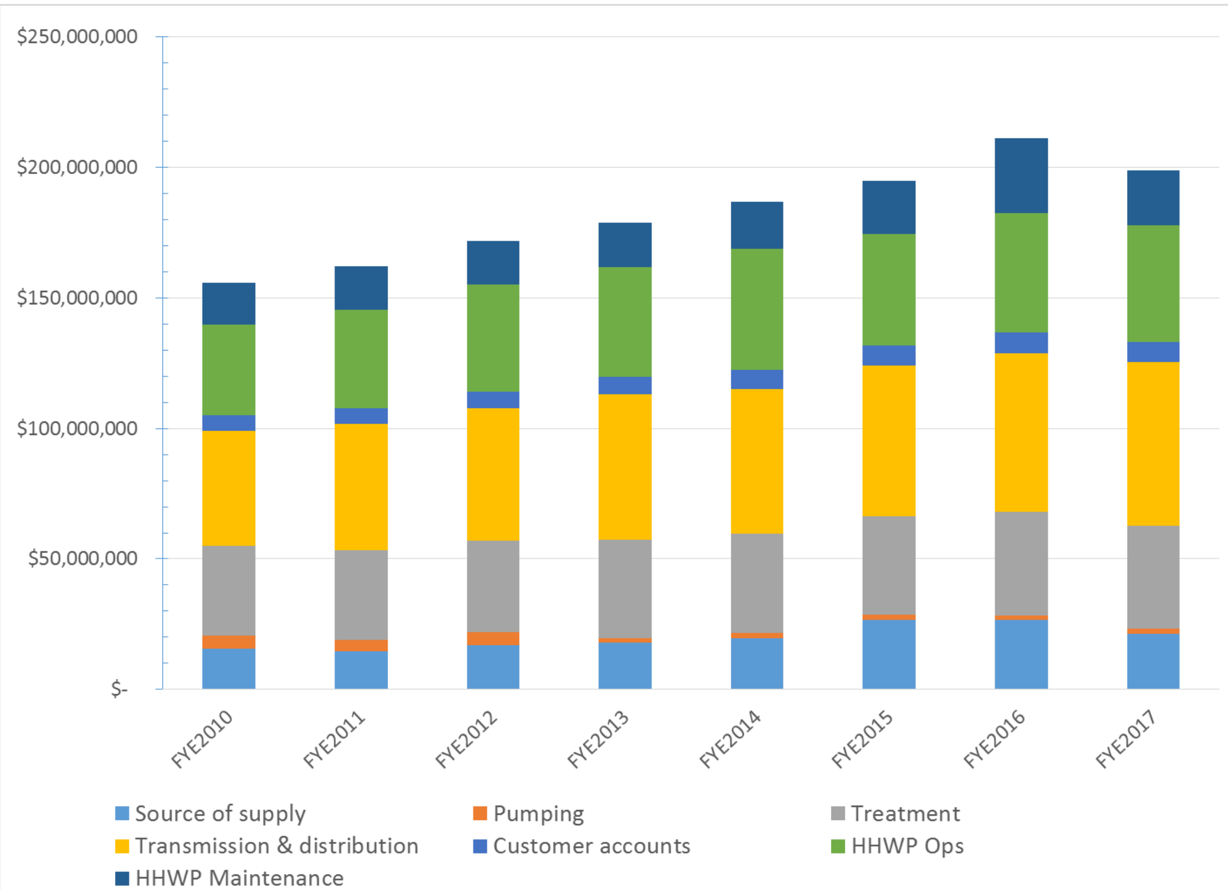
Another area of improvement is to accurately record total maintenance and R&R costs of assets in the RWS. Currently, maintenance functions are performed by multiple divisions and groups in the SFPUC, city departments outside the SFPUC, and outside specialists. Finally, significant maintenance is performed in treatment facilities as part of the daily work routines of assigned water treatment plant staff. This work should be better integrated into the CMMS for a more complete picture of asset management at these facilities.

4. FY17 and FY18 Maintenance Programs and Upcoming Projects

This chapter documents the major accomplishments in maintenance and R&R, as well as upcoming projects. The CIP is presented in Chapter 5. For management and budgeting purposes, the largest maintenance programs are separated into general functional areas. The categories also resemble those used in the CIP. Each program is discussed below, along with major accomplishments in FY17 and FY18, and planned work for future years.

As expected with new WSIP facilities coming online, O&M expenses, as shown in Figure 4-1, have been increasing steadily since FY10 at about 3.4 percent per year, which is more than the inflation rate. The increase has been slightly higher for HHWP than WSTD (3.7 percent versus 3.3 percent). This trend is expected to continue in the coming years.

Figure 4-1: Historical Water Enterprise and HHWP Operations and Maintenance Expenses, as Reported in the Wholesale Revenue Requirement



Most activities in maintenance programs are generated from maintenance-related work orders, either as scheduled PM activities or as reactive corrective-related ones. These activities are usually labor-intensive (typically using in-house labor), and also require materials and supplies. These work orders are charged to operating budgets.

At WSTD, when assets fail and require renewal or replacement, activities are expensed to the R&R budget housed in the capital budget. Regardless of whether or not work orders involve R&R funding, work orders in excess of $10,000 are above the approval authority of lower-level supervisors and management. When this occurs, the work order is considered to be a project and requires division manager approval once scope and budget are reviewed.

Most work in a maintenance program is executed by WSTD staff, but support is often provided by other groups in the SFPUC, other city departments (e.g., many IT functions), or outside consultants and contractors. Staff provide environmental review and compliance for O&M projects, in close coordination with maintenance planning staff.

Underlying all of the activities of the maintenance program is the work by the Maintenance Planning Section at WSTD, which continuously manages the asset inventory, asset condition assessments, and maintenance status. Without accurate information on assets, the planning staff cannot appropriately schedule and prioritize work orders. This section also closely works with the Maintenance Engineering Section at WSTD in reviewing the specifics of job plans to ensure that proper maintenance procedures are outlined.

At HHWP, when assets fail and require R&R, the activity is funded either through HHWP programmatic funds or through the capital fund budget (depending on the project costs and whether the improvement qualifies for bond funding). All projects in excess of $5,000 must go through a management approval process. Larger R&R projects, or projects that cannot be performed by staff, are managed by HHWP's R&R group. Common to all projects is the following support structure:

- environmental support is provided by NRLMD and the Bureau of Environmental Management;
- HHWP's Asset Management group provides coordination of HHWP resources and asset inventory changes;
- Maintenance Engineering supports the project, as requested by the R&R group; and
- a Job Manager is assigned to the project and is accountable for project delivery and budget.

4.1 Water Supply and Storage

This program includes maintenance work on existing dams. The RWS includes fourteen dams under DSOD jurisdiction. There is a multitude of activities related to the inspection and the monitoring of these dams. The RWS is up to date and in good standing per ratings shown in Table 3-1. HHWP is up to date with all DSOD and dam safety program work as provided in Table 3-1. However, Moccasin Dam was recently modified from "Satisfactory" to "Poor" on September 4, 2018, following the March 2018 event. However, following the February 2017 Oroville Dam Spillway incident, change in regulations (see Section 4.8.5) resulted in reprioritization of planning studies at DSOD jurisdictional dams. Although the SFPUC already had EAPs in place for all "extremely high" and "high" hazard dams prior to the new state law, some inundation maps and EAPs needed to be updated and were submitted for all "extremely high" hazard dams prior to January 1, 2018. We are on track to make the requisite submittals for the "high" hazard dams by the required January 1, 2019, deadline. As can be seen in Table 3-2, 14 of the SFPUC's jurisdictional dams are assigned either the "extremely high" or "high" hazard categories, based on downstream hazard considerations (i.e., land use and population downstream).

In addition, the SFPUC received letters from the DSOD to order condition assessments of the spillways for O'Shaughnessy Dam, Cherry Valley Dam, James H. Turner Dam (San Antonio Reservoir), and San Andreas Dam. These condition assessments are all underway, and results will be available within calendar year 2018.

Groundwater wells constructed under the WSIP are expected to be on line in FY18 and FY19, and will be added to the program. This program will eventually encompass alternative supply projects, such as additional groundwater, desalination, and/or recycled water facilities as they become active in the RWS.

4.1.1 Dam Monitoring Program

Field Inspections and Monitoring

Field inspections consist of routine inspections, formal annual inspections, and episodic inspections, accompanied with engineering surveys following seismic events of specified magnitude.

Routine inspections are conducted by SFPUC staff, including engineering survey crews. Staff record monthly readings on piezometers and seepage drains, and also perform routine visual inspection of spillways and appurtenances. The survey crew conducts a routine dam displacement survey on monuments for vertical and horizontal movements. Routine inspections in FY17 and FY18 are listed in Appendix C, Table C-4. Inspection activities will continue in FY19 and FY20 at the similar required frequency.

Annual inspections are conducted by the DSOD inspector, together with the SFPUC inspection team. The DSOD inspects the following: the upstream and downstream face of the dam, the crest and toe areas of the dam, groins, seepage points, spillways, spillway basins, outlet structures, tunnels, valves, piping, and metalwork. The DSOD inspector observes the outlet valve exercise once every 3 to 5 years. The DSOD issues a written report to the SFPUC after each annual inspection to summarize their findings and recommendations. As part of their annual report, the DSOD reviews monitoring data, such as piezometers, deflection and settlement surveys, and seepage monitoring. Annual Inspections by the DSOD were performed in FY17 and FY18, as summarized in Appendix C, Table C-4. The annual inspections will continue in FY19 and FY20, in accordance with the required frequency.

At HHWP, monitoring data are collected manually during the routine monthly inspection and the bi-annual engineering survey. The monitoring data include piezometer readings, seepage flows, survey readings, reservoir levels, and rainfall information. Piezometer readings, reservoir levels, and rainfall data are plotted over a 10-year period to identify trends. Piezometer readings, which represent water pressure, are labeled on each dam cross-section to illustrate the internal phreatic surface. The survey readings that show horizontal and vertical movement are summarized in a tabular format with a 10-year history. The monitoring data are a central element in the reports submitted to the DSOD each year. Maintenance and repair consists of annual flushing of piezometer piping and DSOD annual inspection recommendation follow-ups. The flushing of hydraulic piezometer piping is required to maintain proper operation. DSOD annual inspection recommendation follow-ups generally consist of vegetation clearing, rodent control, minor spillway repair, and repair of seepage measuring devices. These activities are included in the operating budget. Inspections and engineering surveys are required following an earthquake, depending on the magnitude and proximity of the earthquake to the dam. For WSTD, the criteria are specified in the EAPs for each dam. These surveys are conducted immediately or during the next available daylight period. For HHWP, criteria are specified in HHWP's Earthquake Notification Procedure. No earthquakes triggering surveying have been experienced on the HHWP project recently.

At HHWP, monitoring data are collected manually during the routine monthly inspection and the bi-annual engineering survey. The monitoring data include piezometer readings, seepage flows, survey readings, reservoir levels, and rainfall information. Piezometer readings, reservoir levels, and rainfall data are plotted over a 10-year period to identify trends. Piezometer readings, which represent water pressure, are labeled on each dam cross-section to illustrate the internal phreatic surface. The survey readings that show horizontal and vertical movement are summarized in a tabular format with a 10-year history. The monitoring data are a central element in the reports submitted to the DSOD each year. HHWP's dam monitoring and inspection program will be updated over the next 10 years for each HHWP dam. As these changes are made, the dam facility reports will be modified to reflect these improvements to the program. Maintenance and repair consists of annual flushing of piezometer piping and DSOD annual inspection recommendation follow-ups. The flushing of hydraulic piezometer piping is required to maintain proper operation. DSOD annual inspection recommendation follow-ups generally consist of vegetation clearing, rodent control, minor spillway repair, and repair of seepage measuring devices. These activities are included in the operating budget.

Maintenance – Valve Exercising

The valve exercising program requires WSTD to operate the adit valves and emergency release valves for each dam once per year. This can be a work order to be completed by plumbers. Every 3 to 5 years, DSOD inspectors, along with WSTD engineer and inspector, will need to witness the valve exercising for each dam. A wet test with all the valves opened all the way is preferred. When environmental restrictions prevent the full release of water downstream (as was the case for Turner Dam for many years before 2018), a dry test will be done by opening and closing the emergency release valves with the adit valves close (thus not allowing any water to go downstream). After testing, the emergency release valve is then closed and the adit valves are opened and closed.

HHWP's program requires exercising the release valves for each dam once per year. This activity is scheduled in Maximo and performed by the watershed keepers. At least once every three years, DSOD inspectors, along with a HHWP engineer and inspector, witness the valve exercising for each dam. Though a wet test with all the valves opened is preferred, a dry test will be done (not allowing any water to go downstream), during dry hydrologic conditions.

Valve movements in FY17 and FY18 are summarized in Appendix C, Table C-4, and activities will continue in FY19 and FY20, in accordance with valve exercising plan. Valve exercising for pipelines is discussed in Section 4.2.3.

Maintenance – Vegetation Management

SFPUC and DSOD inspections regularly trigger vegetation and rodent clearance work along dams and spillways. This work is transmitted to the maintenance crews for completion via memorandum from the engineering section. See Appendix C, Table C-4 for a summary of vegetation management activities for FY17 and FY18. Similar activities are planned for FY19 and FY20, as required.

SFPUC and DSOD inspections regularly trigger vegetation and rodent clearance work along dams and spillways. This work is transmitted to the maintenance crews for completion via memorandum from the engineering section. See Appendix C, Table C-4 for vegetation management activities.

Repairs

"Repairs" includes work that cannot be capitalized, and refers to maintenance and small R&R projects. A list of dam repair tasks for FY17 and FY18 and planned for FY19 and FY20 is provided in Appendix C, Table C-4.

4.1.2 Planning Studies and Improvement Planning

Improvements to facilities are often identified through planning studies, such as condition assessments or engineering evaluations. Depending on the findings of the studies, maintenance and/or capital projects may be required to address the needs. This section describes recent planning studies for dam facilities and how they have led to current maintenance improvements or the capital projects that are described in Section 5. It is important to understand that capital projects are prioritized along with other RWS work required and with budget constraints. This explain why certain work take a long time between assessment and implementation.

Seismic stability studies and analyses were conducted for LCSD, San Andreas Dam, Pilarcitos Dam, and Calaveras Dam in the 1970s and 1980s, as required by the DSOD. Extensive studies were conducted based on regional and dam site-specific geology, seismicity of two active fault systems (Calaveras and San Andreas), subsurface exploration and soil sampling, and characterization of the embankments and foundations. Although updates to these stability studies are not generally required by the DSOD, the SFPUC plans to update them approximately every 15 years in conjunction with outside experts to incorporate any new findings on subsurface materials or new seismic criteria. This frequency allows review of approximately one DSOD-jurisdictional dam per year in the SFPUC system.

The inundation maps for all of the dams were last updated in the 1970s, as required by the State Office of Emergency Services. The maps show areas of potential flooding in the event of catastrophic and total failure of the dam. Following the new state law, inundation maps were submitted for all "extremely high" hazard dams prior to January 1, 2018.

In FY12, the SFPUC developed guidelines to better interpret piezometer data for LCSD, Pilarcitos, San Andreas, and San Antonio Dams. These guidelines allow staff to more rapidly identify problems with dam stability. URS reviewed all relevant studies and examined historical reservoir, rainfall, and instrument data to determine a matrix of response actions to guide safe operations of the four regional reservoirs.

At HHWP, seismic stability studies and analyses are conducted with each condition assessment. Refer to Appendix C regarding studies performed to date and timing of upcoming condition assessments. As stated in the previous State of the RWS report, HHWP's dam monitoring and inspection program will be updated over the next 10 years for each HHWP dam. As these changes are made, the dam facility reports will be modified to reflect these improvements to the program. Changes in monitoring systems are already scheduled into the 10-year capital plans.

EAPs are prepared for each dam. Each EAP includes roles and responsibilities, notification flowchart with notification procedure, mitigation activities, and inundation map. These documents are updated annually and are up to date, as indicated in Appendix B. Tabletop exercises are scheduled annually, rotating through each HHWP reservoir once every 5 years (to accommodate the six reservoirs, a tabletop exercise will be performed for two reservoirs once every 5 years). For the larger reservoirs, the National Park Service, Tuolumne County Sheriff, United States Forest Service, and Turlock Irrigation District will participate in future tabletop exercises. Dam EAPs contain information on critical assets. These EAPs are provided to the United States Army Corps of Engineers, the Districts, DWR, Tuolumne County Office of Emergency Services, and Tuolumne County Sheriff's Office HHWP personnel also participate annually in Turlock Irrigation District's EAP tabletop exercises for Don Pedro Reservoir. Similiar to HHWP, Tabletop exercise is scheduled annually, rotating through each WSTD reservoir once every 5 years. The first table top EAP exercise started in 2017 for Turner Dam. Calaveras Dam EAP table top exercise is scheduled for 2018.

O'Shaugnessy Dam

To date, regular annual inspections of O'Shaughnessy Dam have not revealed a need for capital work on the dam itself. Most capital and maintenance work at this facility is limited to the outlet works and spillway that release water from Hetch Hetchy Reservoir to Canyon Tunnel and the Tuolumne River. The projects were identified by a 2009 condition assessment of the outlet works, and through the SFPUC dam inspection and monitoring program (as stated in Appendix C, a detailed condition assessment was performed on the outlet works in 2009, not to be confused with a regular, less detailed annual inspection of the entire dam). The scope identified from the 2009 condition assessment is large and has been divided into a series of smaller projects based on priority, budget, type of construction, and location. This information was summarized in a "Planning Report," which was completed in 2015 and used as the baseline strategy for the overall project.

All projects are identified in the 10-year capital plan and are scheduled following the prioritization system of work in the RWS., and their statuses are summarized below.

- **Drum Gate Automation:** this project was completed in June 2017.
- **Access and Drainage Improvements:** this project is in the planning phase and is forecast to start in December 2019 and be completed in 2020.
- **Drum Gate Rehabilitation:** this project is in the planning phase and is forecast to start in February 2021 and be completed in 2022.
- **Installation of New Bulkhead System:** this project is in the planning phase and is forecast to start in December 2019 and be completed in 2020.
- **Rehabilitation of Slide Gates and New Diversion Pipe Isolation Valve:** this project is in the planning phase and is forecast to be completed in 2023.

Additional outlet works projects included in the capital plan in 2018 include:

- replacement of a 72-inch needle valve and rehabilitation of a 72-inch butterfly valve;
- replacement of 60-inch needle valves and controls; and
- diversion tunnel rehabilitation.

These projects from the 2009 condition assessment will improve the safety and functionality of the reservoir release system. The release valves need to be upgraded due to their age and the safety concerns that have become apparent since their installation. Safety concerns are primarily related to the seven balance needle valves.

The HHWP capital budget also includes R&R funding, which is maintained to address unplanned projects at dams and appurtenances.

A detailed evaluation of the O'Shaughnessy spillway is underway and is scheduled to be completed in early January 2019. In FY23, a formal condition assessment of O'Shaughnessy Dam (excluding the spillway) is planned. This more comprehensive condition assessment will provide a better understanding of the dam's current condition, and of additional investments that may be required over the next 20-year period.

In addition to capital improvements, a new inundation map is being developed and will be completed in 2019.

Cherry Valley Dam

To date, regular inspection of Cherry Valley Dam has not revealed a need for capital work on the dam itself. Most capital and maintenance work at this facility is limited to the outlet works and spillway that release water from Cherry Valley Dam to Cherry Creek. Two projects were identified through a 2012 condition assessment, and through normal operations. The first project was for the replacement of the 66-inch hollow-jet valves with 66-inch fixed-cone energy dissipating valves and motor operators. The two hollow-jet valves that discharge into Cherry Creek are primarily used to regulate the Lake Lloyd storage and to prevent flow from discharging over the spillway. This project was scheduled for fall 2017. During January 2017, one of the 84-inch butterfly valves upstream of the hollow-jet valves failed. The valve project was expanded to include rehabilitation of the butterfly valves upstream of the proposed cone valves. The project was completed in spring of 2018.

The second project is to correct deficiencies in the spillway channel leading from the dam spillway to Cherry Creek. The Cherry spillway is designed for a capacity of about 52,000 cfs. However, the spillway channel to Cherry Creek can only accommodate that design flow. To maximize the SFPUC carryover storage, the spillway channel must be improved. A detailed evaluation of the spillway and spillway channel is underway. The assessment will be completed in early January 2019. Following completion of this study, it will be determined whether additional capital improvements are required.

The HHWP capital budget also includes R&R funding, which is maintained to address unplanned projects at dams and appurtenances.

In addition to the capital improvements, new inundation maps are being developed and will be completed in 2019.

Eleanor Dam

A formal condition assessment of Eleanor Dam was completed in 2016. The assessment documented the overall condition of the dam and identified multiple deficiencies that need to be corrected, including:

- Vehicle Bridge Spanning the Dam: The bridge provides two purposes; support work related traffic over the dam and seismic resistance. A recent study has determined the current load rating is sufficient for work related traffic (2017), however, rehabilitation of the bridge is required to meet seismic resistance requirements;
- Spillway Capacity: Improve spillway capacity to avoid dam overtopping; and
- Leakage: Reduce leakage through the lift lines,[17] if not corrected, will reduce the overall life of the facility.

In the short term, HHWP will limit the load on the bridge and continue to monitor the dam's condition under the HHWP's Dam Safety Program (see Section 4.1.1). Improvements to the dam and bridge are being planned. The project is estimated to be completed prior to 2022. The remaining projects have been added to the 2018, 10-year capital plan.

In addition to capital projects, new inundation maps are being developed and will be completed in 2019.

Priest Dam

A review of monitoring data in August 2013 identified several data deficiencies in the piezometer system that needed to be addressed to ensure that the integrity of the dam could be monitored. Additionally, the review identified the need for future geotechnical investigations and analyses to address the dam's overall stability. HHWP initiated a project to design and construct new monitoring instrumentation and to perform an overall condition assessment of the dam, including an updated stability analysis. This project is forecast to be completed by 2022. Based on the nature of the deficiencies and risks, the time frame is adequate and the priority of this project is not as urgent as other projects. If additional scope is identified through condition assessment, HHWP will propose new projects in the future capital plan.

In addition to capital projects, new inundation maps are being developed and will be completed in 2019.

[17] The entire height of an arch dam is not constructed from a single concrete placement. Instead, the dam consists of multiple smaller placements of concrete, commonly referred to as "lifts," that are typically between 2 and 5 feet thick. Each lift is placed on top of each other until the desired overall dam height is achieved. The horizontal joint that forms between each lift is referred to as the "lift line" and is designed and constructed to be watertight.

Moccasin Dam

In March 2018, a large precipitation event resulted in a flash flood with unprecedented inflows, including a debris flow, that overwhelmed the Moccasin Diversion Dam. As a result, HHWP has identified $22 million in interim projects that are required by our regulator, DSOD, prior to returning Moccasin Reservoir to service. The major scope elements include: extending the lower dam's concrete core wall, repairing the auxiliary spillway, repairing erosion damage to both dams, installing a berm downstream of the lower dam, improving access to the lower level outlet, and re-establishing stormwater routes around the Moccasin Reservoir. Interim repairs and improvements are planned for 2018, with the goal of placing the reservoir back into service in fall 2018. Over the next year, the design flood will be reexamined to determine whether additional modifications are required over the longer term.

Additional projects include a new inundation map to be completed in 2018, and a security project of fencing around the lake to restrict access.

Early Intake Dam

A condition assessment of Early Intake Dam was completed in March 2014. Early Intake Dam and spillway have a long history of structural degradation and extensive seepage due to alkali-aggregate reaction[18] in the concrete. Even after repair work, seepage and structural cracks continue to develop on the dam surface, crest, and gravity thrust blocks. Historical survey data indicate continuing movement of the concrete arch structure, which may lead to failure of the dam.

The HHWP currently has a program to monitor the cracks at the dam. A needs analysis of the facility is planned for FY20. Based on the outcome of this analysis, rehabilitation or removal of this facility will be proposed.

Calaveras

Construction of a replacement dam began in early FY12. Construction will continue through FY19. We anticipate putting forth a CIP project to automate the geo-monitoring points, including piezometers, inclinometers, and survey monuments that are not currently included in contract. An inundation map was revised in FY10.

Upper Alameda Creek Diversion Dam

The Upper Alameda Creek Diversion Dam is structurally sound, but the sluicing gates have limited operational ability, and significant sedimentation has accumulated upstream. The structure is now being modified under the CDRP, and will include a new fish passage ladder and screened intake into the diversion tunnel that leads to Calaveras Reservoir. Diversions through the tunnel to Calaveras Reservoir have not been performed since the winter of 2011-2012, and may not occur until more storage is available in Calaveras Reservoir. Downstream bypass flows have been provided, consistent with the construction permitting requirements.

[18] Alkali-silica reaction is a reaction in concrete between the highly alkaline cement paste and the reactive silica found in aggregates. These aggregates are native to the Moccasin area.

Turner Dam (San Antonio Reservoir)

During FY12, the inundation map was updated for Turner Dam. In December 2017, the SFPUC completed the inundation map for a hypothetical spillway failure. Both inundation maps of failures of the dam and spillway were submitted to the DSOD in December 2017. The SFPUC initiated the seismic stability evaluation of the dam in fall of 2017. The study is expected to be completed in the fall of 2018. The spillway is currently undergoing comprehensive condition assessment directed by the DSOD. Phase 1 of this evaluation will be completed late 2018. Depending on the outcome of the assessment, there may be CIP work in the future associated with the spillway.

During FY12, the inundation map was updated for Turner Dam. In December 2017, SFPUC completed the inundation map for a hypothetical spillway failure. Both inundation maps of failures of the dam and spillway were submitted to DSOD in December 2017. SFPUC initiated the seismic stability evaluation of the dam in fall of 2017. The study is expected to be completed in the fall of 2018. The spillway is currently undergoing comprehensive condition assessment directed by DSOD. Phase 1 of this evaluation will be completed late 2018. Depending on the outcome of the assessment, there may be CIP work in the future associated with the spillway.

The downstream spillway ground was eroded during a spill event in early 2017. Repair was planned for the summer of 2018. But because the necessary environmental permits were not ready and the construction cost exceeded the limit of a Job Order Contract, the construction must be postponed to summer 2019. Interim operation was agreed on with the DSOD. Throughout the winter season and until April 15, the reservoir is restricted to 4.5 feet below the spillway crest. After April 15, the restriction is raised to 1 foot below the spillway crest. Because of the delayed repair of the erosion, DSOD has changed the condition assessment rating of the Turner Dam facility from Satisfactory to Fair (see Table 3-1).

Lower Crystal Springs Dam

The elevation of the reservoir continues to be maintained at 10 feet below the spillway. This is because native plant mitigation is required before the restored maximum storage capacity can be fully utilized, under the conditions of federal and state environmental permits that were part of the WSIP spillway upgrade project. As required under the conditions of federal and state environmental permits, the SFPUC has been making continual releases to San Mateo Creek since January 2015.

An updated inundation map was completed for LCSD in FY11. This study also included a review of the most recently available hydrology data in the San Mateo Creek watershed, to ensure that the 100-year flood assumption used by Federal Emergency Management Agency (FEMA) was appropriately conservative.

The SFPUC completed an investigation on the concrete strength of the dam. The objective of the investigation was to verify and confirm the physical properties of the concrete. Results published in 2012 confirmed the concrete strength, with no signs of deterioration. In FY12, the SFPUC also initiated a stability analysis of the dam. The purposes of this study were to reconfirm the safety and stability of the dam, and to fulfill a commitment from the SFPUC to downstream stakeholders to perform an in-depth reevaluation of the dam's stability using the most appropriate analytical techniques and seismic standards. This study was completed in

October 2013. Due to a history of overflow conditions, there are two piezometers at the toe of the dam. These two piezometers will be retrofitted as part of a larger project, which is a widening and deepening San Mateo Creek for a fish passage. Included in this project is abandonment of the old Crystal Springs Reservoir outlet pipe and deactivation of an inline valve. The project will be in construction in summer 2019. In addition, the old outlet pipe will be decommissioned in summer 2018.

In response to new state law—Senate Bill 92, enacted in July 2017—the SFPUC submitted to the DSOD an inundation map of a hypothetical dam failure.

Upper Crystal Springs Dam

Although the dam crosses the San Andreas fault, no improvements to the dam are planned. The culverts conveying water into LCSR were repaired and strengthened under the WSIP.

San Andreas

An updated inundation map was completed for the San Andreas Dam in December 2015. Upon a hypothetical failure of San Andreas Dam, San Andreas Reservoir will flow into LCSR and ultimately spill into San Mateo Creek. Senate Bill 92, enacted in July 2017, required an inundation map of a hypothetical failure of high-hazard dams to be submitted prior to January 1, 2019. Studies have been planned in anticipation of this requirement.

The spillway is currently undergoing comprehensive condition assessment directed by the DSOD. The study is underway and it is anticipated to be completed in 2019. Depending on the outcome of the assessment, there may be CIP work in the future associated with the spillway. A stability analysis for San Andreas Dam will be initiated in the near term.

The seismic stability of San Andreas Dam was last evaluated in the early 1980s. The SFPUC plans to conduct a seismic stability evaluation of the dam in 2019.

Pilarcitos

In FY15, the SFPUC awarded a Professional Service Contract, titled "Pilarcitos Dam and Reservoir Improvement Project," to AECOM, to assist in the areas of dam upgrades, geotechnical investigation and engineering, structural and seismic engineering, hydraulic and hydrologic engineering, engineering planning, engineering design, and engineering support during construction for the dam and outlet structure. The contract is for $3 million, with a duration of up to 9 years. The project completed the following reports: Management and Data Review/Materials Characterization, Outlet Structure Data Review and Visual Inspection, and Fault Assessment Seismic Hazard and Ground Motions in FY16 and FY17. The completed reports in FY17 and FY18 include Tunnel and Portal Inspection, Forebay Data Review Technical Memorandum, Geotechnical Exploration Work Plan, and Reservoir Drawdown Technical Memorandum. The project team recently released the Forebay and Outlet Structure Preliminary Structural Analysis and Seismic Evaluation for review. In FY19 and FY20, we anticipate the work to include geotechnical exploration of the embankment, spillway, and forebay; hydraulic evaluation of the spillway; and inundation map for hypothetical failure of the dam. The SFPUC anticipates that a capital project and other improvements will be necessary for the Pilarcitos system, and has included funding in the CIP.

Senate Bill 92, enacted in July 2017, required an inundation map of a hypothetical failure of high-hazard dams to be submitted prior to January 1, 2019. Studies have been planned in anticipation of this requirement.

Stone Dam

Stone Dam, downstream of Pilarcitos Reservoir, is in satisfactory structural condition, but structural deterioration of the spillway access structure prevents operational use of its stop logs, and the reservoir storage capacity is severely limited due to sediment deposition and lack of regular dredging.

Sunset Reservoirs

Construction is near completion at Sunset Reservoir North and South Basins to accommodate the SFPUC's new groundwater sources. This construction included the permitting and startup of four new drinking water wells, which deliver water to and are blended in the 180-MG Sunset Reservoir with the SFPUC's surface water. New construction, monitoring, and controls for groundwater blending at Sunset Reservoir include more than 4 miles of conveyance piping from Golden Gate Park and the Avenues, pipe diffuser systems across the 1,000-foot by 500-foot basins, SCADA controls, flow metering, water quality analyzers, and chlorination and pH adjustment systems.

Sunset Reservoir North Basin was isolated in the first half of FY17 in response to nitrification in the basin (a malfunctioning Solarbee mixer exacerbated the declining chlorine residuals in the basin). CDD Ops "boosted" residuals, repaired the mixer, then placed the Basin back into service in November 2017.

Merced Manor Reservoir

Structural repair of Merced Manor is required, because the exterior concrete structural components are cracking and spalling in some locations. There is a capital program in the Regional CIP to perform an assessment and repairs.

4.2 Transmission

Several sub-programs make up the transmission maintenance program. Many of the itemized activities were sometimes performed in concert with WSIP construction, taking advantage of shutdowns that offered opportunities to inspect and replace various assets. Transmission pipeline valve exercising has not kept pace with goals, due to extended WSIP pipeline and warranty inspections, but will increase as WSIP pipeline inspections are completed. Corrosion systems continued to be upgraded at a high rate; cathodically protected transmission pipeline increased from 75 miles in 2014 to 115 miles in 2016, and is expected to increase to 165 miles in 2019-2020 (largely making up for lack of a formal program prior to 2008).

As pipelines are taken out of service for construction and O&M activities, associated pipeline appurtenances must be operable to accommodate isolation, dewatering, and disinfection activities. Consequently, all related appurtenance valves, vaults, drainage paths, and some line valves are serviced on affected pipelines as required.

4.2.1 Pipeline and Tunnel Repairs

San Joaquin Pipelines

The 2018, 10-year capital plan includes 1) the Life Extension Program; and 2) the SJPL Entry Assessment and Valve Improvement Project (including the Tesla Valve Replacement Project).

Through the capital program, HHWP maintains the R&R SJPL Life Extension Program. The purpose of the program is to extend the life of the asset. The program includes inspection and renewal of the pipelines and appurtenances. HHWP uses two inspection techniques: external inspection performed through excavations, and internal inspection using an in-line inspection tool. The tool identifies areas of thin wall that require repair and/or replacement of long sections of pipe with significant corrosion. In 2017, 36 miles of SJPL No. 1 were inspected with the in-line tool. Areas for rehabilitation have been located and are being corrected. The in-line tool also identified a section of damaged pipe which was the result of agricultural activities. This section of pipe is scheduled to be replaced in 2019. The in-line tool has demonstrated that where inspection has been performed on SJPL No. 1, the pipeline is in good condition. With areas of concern identified and corrected, the asset is expected to perform well, with a reduced likelihood of unplanned outage in areas where inspection has been performed. Additional inspection may impact planned projects in the 10-year capital plan.

In addition to inspection, rehabilitation work has also been performed on the SJPLs. Over the last 2 years, projects have included crack repairs on the coating of SJPL No. 4; cathodic station rehabilitation; improvements to the acoustic fiber optic monitoring system on the PCCP; replacement of 165 feet on SJPL No. 1, identified with the in-line inspection tool; testing terminals on the valve boxes to facilitate corrosion; USA testing without confined space entry; lining improvements on SJPL No. 1; valve box raises to accommodate third-party road-widening improvements; joint rehabilitation on SJPL No. 1 at the San Joaquin River; and improvements at the SJPLs to accommodate third-party roadway crossing/widenings in the San Joaquin Valley.

Larger capital work includes the SJPL Entry Assessment and Valve Improvement Project (including the Tesla Valve Replacement Project). This project will ensure safe access of the pipelines for maintenance, inspection, and rehabilitation. Improvements include, but are not limited to, properly rated valves for safe access at Tesla and each crossover, and improvements to address surge in the event of valve closures at TTF. Design is preliminarily scheduled for 2020, with project completion by 2023.

Lower Cherry Aqueduct

The diversion dam is currently not functioning, due to damage caused during the 2017 floods. The head gates nor sluice gates at the diversion dam are operational due to deposited sediment impacting their use. This equipment was previously damaged during the 2013 Rim Fire. Immediate temporary repairs were made through an emergency contract in 2014 making system functional.

Due to necessary Right of Way corrections, the permanent repair contract was delayed. The scope of the current active contract includes debris removal impacting the gates, permanent repairs on the sluice gates, diversion dam repairs, new gatehouse structure, new hydraulic building and controls, and forebay repairs. Substantial Completion for this contract is January 2019.

Canyon Power Tunnel

In 2007 and 2008, HHWP staff observed increased leakage at the Hetch Hetchy Adit weir. During a 5-day shutdown in January 2009, temporary repairs to the concrete plug in the Hetch Hetchy Adit of the tunnel were undertaken to reduce the 200 to 300 gallons per minute exiting from cracks and deteriorated concrete in the plug. The tunnel was last inspected in November 2009. The tunnel is in very good condition, but rehabilitation work is required at the Hetch Hetchy Adit, where leakage has occurred. A permanent replacement of the concrete plug will be necessary to mitigate the future risk of developing new cracks that would result in the loss of water from the Hetch Hetchy system. This project has been delayed due to access issues relating to an undersized historic bridge. Work will be coordinated with one of the future Mountain Tunnel shutdowns.

Mountain Tunnel

Condition assessments (in 2006 and 2008) have identified degradation of the lining on more than 9 miles of lined sections of tunnel. The SFPUC is currently active on three parallel tracks regarding Mountain Tunnel Investigation and Rehabilitation Projects, including:

- the Mountain Tunnel Adits and Access Improvement Project;
- the Mountain Tunnel Inspection and Repairs Project; and
- the Mountain Tunnel Long-Term Improvements Project.

A complete shutdown and draining of Mountain Tunnel was performed during January and February 2017 to accomplish the Inspection and Interim Repairs Project and the Adits and Access Improvement Project, as well as to develop information and knowledge for the design and construction of the Long-Term Improvements Project.

The Mountain Tunnel Inspection and Repairs Project resulted in the successful completion of a detailed inspection of the entire length of the tunnel, including visual inspections; photography and video documentation of lining defects; more than 50 core samples of lining material; and survey marking of all lining defects. It also included repairs of different lining defect locations in about 8,000 linear feet of the tunnel sites. Additional interim repairs will be performed in a planned January 2019 60-day shutdown, to reduce the risk of failures in the concrete lining.

The Mountain Tunnel Adits and Access Improvement Project was intended to address the critical nature of the potential impact of lining failure on water delivery obligations. Mountain Tunnel must be returned to service within 3 months in the event of a water service interruption. To accommodate quick entry of construction crews and equipment into Mountain Tunnel, improvements were made at Adit 5/6 and Adit 8/9, and access roads and adits (access passages to the tunnel) were constructed to minimize the time required to return the tunnel to service. An Emergency Restoration Plan has been prepared to establish an outline for basic service restoration plans and procedures. The monitoring system to assess changed conditions in the tunnel also was enhanced to complement the existing system.

The Mountain Tunnel Long-Term Improvements project provides for evaluation of alternatives for the Mountain Tunnel facility, and eventually the design and construction of the preferred engineering alternative that will keep this vital component of the HHWP System in reliable service. Sufficient information was collected during the early 2017 shutdown, inspection, and repairs to allow for the development of a proposed preferred alternative for the Long-Term Improvements Project. The preferred alternative is a rehabilitation/repair project with the addition of flow controls (valving) on the downstream end of the tunnel in or near Priest Reservoir. The flow controls will allow the tunnel to be operated in a full state at different flow rates, which will reduce lining deterioration.

Based on the preferred alternative described in the preceding paragraph, improvements to Mountain Tunnel, a jointly owned asset with the Power Enterprise, are now projected to cost approximately $227 million over the 10-Year Capital Plan period, not including the costs of interim repairs to be performed as part of the shutdown planned for 2018. The revised cost of the Mountain Tunnel improvements is reflected in the 10-Year Capital Plan for FY 2018-19 to FY 2027-28, adopted by the commission of the SFPUC in February 2018.

Current project objectives include replacing the temporary manifold at South Fork Adit that was installed in the winter of 2008-2009. Though infiltration at this location is not a threat at this time, a permanent fix needs to be installed, and is included in all Long-Term Improvements Project alternatives currently under consideration.

The second objective of the Long-Term Improvements Project is to reduce the likelihood of a lining failure. Lining failures can range from “local collapses” to catastrophic failures. The likelihood of lining failures at Mountain Tunnel was discussed with Dr. Gregg Korbin, a member of the consultant team that inspected Mountain Tunnel in 2008. Given the current condition of Mountain Tunnel, the anticipated failures are local collapses. These types of failures will not impact tunnel flow capacity (no impact to power generation), but could cause turbidity excursions that impact water quality. In Dr. Korbin’s opinion, the likelihood of localized collapses is moderate to high.

Operational impacts of turbidity events associated with a local collapse will vary depending on system delivery configuration. Based on previous experience, HHWP Operation staff has successfully managed turbidity events when both Priest and Moccasin reservoirs are in service, settling out the turbidity in these reservoirs without significantly impacting water deliveries. Conversely, when Priest and/or Moccasin bypasses are in service, the turbidity will bypass the reservoirs and travel directly into Foothill Tunnel and the San Joaquin Valley water transmission system. Turbidities above water quality triggers would require filtration or diversion of the Hetch Hetchy source.

Moccasin Power Tunnel

Difficult access to the 6,000 foot long Moccasin Power Tunnel above the West Portal Valvehouse impedes our ability to perform an inspection. Water stored in the power tunnel serves as a water supply source during rehabilitation work, such as Mountain Tunnel, which limits the opportunities to enter the tunnel. We will work on finding an opportunity to inspect the Moccasin Power Tunnel before 2020.

Bay Division Pipelines

Based on an inspection in December 2009, repairs to the interior cement mortar lining of BDPL No. 4, Section B, will be about $2 million; these repairs are included in the CIP (Water Transmission Program). Repairs will be spread throughout the full length of BDPL No. 4, Section B. They will encompass about 47,400 feet, with roughly 15,000 square feet of affected area.

Inspection in August 2015 on BDPL No. 1, between valves B15 and B18, revealed lining failure at several locations for both dielectric and cement mortar lined sections. Inspection in May 2017 on BDPL No. 4, Section D, showed that segments of PCCP are in high risk of failure and should be repaired and replaced. The lining repair for BDPL No. 1 and pipe rehabilation for BDPL No. 4 will be addressed in the CIP.

San Antonio Pipeline

In October of 2017, there was a leak on the 60-inch PCCP San Antonio Pipeline in the Sunol Valley. The failure occurred at a transition from PCCP to steel fitting, and was caused by seismic ground motion from the meandering Calaveras Fault through the Sunol Valley. The leak took place 1 month before a scheduled Hetch Hetchy shutdown in the fall of 2017. To keep the shutdown on schedule, SFPUC crews attempted the internal repair while the Contractor was on standby, ready to replace a section of PCCP. The internal repair was a success, and there is no need for replacement of PCCP.

4.2.2 Pipeline and Tunnel Inspections

The SFPUC regularly performs internal pipeline inspections to proactively find potential vulnerabilities in transmission pipelines before major problems occur. A combination of acoustic sounding (with ball peen hammer) and visual inspections is performed for all pipelines. For PCCP, an additional electromagnetic test is performed by a specialized contractor, to determine the number of broken prestressed wires. These methods have been used throughout the industry for more than 10 years, and are considered state-of-the-art methods.

WSTD has created a schedule for inspecting approximately 253 miles of pipeline over the next 20 years (See Appendix C, Table C-2: 20-Year Pipeline Inspection Schedule). This schedule was created using a multi-step process based on a pipeline's likelihood to fail, and the consequences of failure. This process emphasized public safety by prioritizing inspections for pipelines that have the highest chance of catastrophic failure and are near the public. Appendix E describes the process used to prioritize pipeline inspections and create the pipeline inspection schedule.

Inspections on the schedule are listed by quarters (generally listing the first date of the quarter as a placeholder for the inspection in that quarter). Once the actual date is determined, the inspection date on the schedule could be changed accordingly.

After pipelines have been inspected, the pipeline condition information from the inspection will be used to help make an informed decision when prioritizing Capital Improvements Projects for each pipeline segment.

Pipeline and Tunnel Inspections Performed in FY17 and FY18

San Joaquin Pipelines

For WSP, HHWP uses two inspection techniques: external inspection performed through excavations, and internal inspection using an in-line inspection tool. The tool identifies areas of thin wall that require repair and/or replacement of long sections of pipe with significant corrosion.

Through the capital program, HHWP maintains the R&R SJPL Life Extension Program. The purpose of the program is to extend the life of the linear asset prior to replacement. The program includes inspection and renewal of about 39 miles of SJPL No. 1. This pipeline was inspected with the in-line tool in 2009, 2010, and 2017. Areas for rehabilitation have been located and are being corrected. The in-line tool identified a section of pipe that was damaged by agricultural activities. This section of pipe is scheduled to be replaced in 2019. SJPL No. 1 is in good condition where it has been inspected using the in-line tool. With areas of concern identified and corrected, the linear asset is expected to perform well, and with a reduced likelihood of unplanned outage in areas where inspection has been performed.

Foothill Tunnel

The tunnel was last inspected by Jacobs Associates in early 2007. With the exception of the pipe section near the Oakdale Portal, the overall condition of the Foothill Tunnel and associated shafts is good. Minor seepage was observed. The presence of multiple short, lined sections suggests that shear zones and localized rock instabilities were frequent but well defined during construction. The poorer rock sections do not affect the tunnel's reliability, because of the relatively good quality of the short, concrete-lined sections. The relatively small size and low number of rock falls in the unlined sections is a good indicator of the rock quality and overall competence. Jacobs Associates recommended a tunnel inspection in 2017. Due to the emphasis on Mountain Tunnel, HHWP will propose a condition assessment at a later date. Inspections are prioritized based on previous condition assessment, asset availability for inspection, resources and available funding. HHWP may not inspect the tunnel until after the Mountain Tunnel Rehabilitation project is complete due to return-to-service restrictions during construction.

Eleanor-Cherry Tunnel

An informal inspection of the Eleanor-Cherry Tunnel was performed by HHWP staff in October 2015. The tunnel is unlined and is in very good condition. No work or additional inspection is planned in the near future.

Pilarcitos Tunnel 1 (Pilarcitos Reservoir to San Mateo Creek Dam 1 – 0.29 mile)

The Pilarcitos Tunnel 1 was inspected in July 2016, from Pilarcitos Reservoir to San Mateo Creek Dam 1 (also known as Mud Dam 1). The 3-foot 6-inch by 5-foot 1-inch tunnel was constructed in 1868, using brick and mortar. Several anomalies were noted during the inspection, the most common being evidence of calcium growth along the top half of the tunnel and the presence of recessed, uneven, or cracked bricks in the tunnel. No major issues were noted.

San Antonio Pipeline (Entire pipeline – 2.07 miles)

The 60-inch PCCP was installed in 1967, and was inspected in August 2016. Electromagnetic inspections were performed by Pure Technologies to identify broken prestressing wire wraps, the main cause of failure in PCCP pipelines. The inspection showed the pipeline to generally be in good condition.

Crystal Springs Pipeline No. 2 (Millbrae Yard to Baden Valve Lot – 3.86 miles)

The 60-inch WSP pipeline with coal tar lining was installed in 1937, and was inspected in October 2016. Localized areas with lining damage were identified during the inspection. Repairs will be made as part of a future pipeline rehabilitation project.

Alameda Siphon No. 3 (Entire pipeline – 0.55 mile)

The Alameda Siphon—a 96-inch PCCP, connecting between the CRT and the Irvington Tunnels—was installed in 1967, and was inspected in October 2016. Electromagnetic inspections were performed by Pure Technologies. The inspection showed the pipeline to generally be in good condition.

Bay Tunnel (Newark Shaft to Ravenswood Shaft – 5.14 miles)

The 108-inch Steel Tunnel has concrete mortar lining. It was built in 2015 as part of the WSIP program, and was inspected in November 2016. This was an initial service inspection to determine whether there were any defects in the tunnel prior to the end of the warranty period. The inspection was performed by ASI Marine using an underwater Remotely Operated Vehicle. No major issues were noted.

Calaveras Outlet Pipe (Outlet Tower to V34) and Adit 2 (Reservoir to Outlet Tower)

The Calaveras outlet conduit consists of 72-inch and 78-inch pipe sections installed in 1992, 2013, and 2016. It was inspected in May 2017. The inspected section is a WSP pipeline with a polyurethane or epoxy lining. Localized lining defects caused by debris from the reservoir were noted and repaired. Also inspected in May 2017, the Calaveras Adit 2 is a 48-inch, reinforced concrete, horseshoe-shaped tunnel originally installed in 1926. It was sliplined with a steel liner in 1935 and relined with an epoxy lining in 2012. Localized lining defects caused by debris from the reservoir were noted and repaired.

Bay Division Pipeline No. 4 (D50 to D68 – 7.86 miles)

The 84-inch PCCP was installed in 1967, and was inspected in May 2017. Electromagnetic inspections were performed by Pure Technologies. A segment of about 150 feet of pipeline will be repaired or replaced.

Crystal Springs Pipeline No. 3 (L30 to L41K – 3.30 miles)

The 60-inch PCCP was installed in 1971, and was inspected in November 2017. Electromagnetic inspections were performed by Pure Technologies. The inspection showed the pipeline to generally be in good condition.

Crystal Springs Bypass Tunnel

The Crystal Springs Bypass Tunnel was constructed and put into service in 1969; due to system constraints, it has not been inspected since being put into service. The Crystal Springs Bypass Tunnel was drained to accommodate the tie-in of the New Crystal Springs Bypass Tunnel with the existing pipelines. The shutdown occurred in January 2011 and provided an inspection window of opportunity.

Jacobs Associates, the consultants tasked with the cursory visual inspection of the tunnel, found the overall condition of the tunnel to be good, although there were clear indications that monitoring of the steel-lined sections near the downstream portal is needed. Additionally it was observed that:

- the G-20 gate house was structurally sound and in good operating condition;
- the transition between the gate shaft and the tunnel was in excellent condition;
- the concrete-lined tunnel was in good condition; and
- the cement-mortar-lined (CML) and steel-lined sections of the tunnel included some spalled CML and extensive rust tubercles, consistent with pit corrosion processes.

Jacobs Associates recommended that the steel-lined section of tunnel be reinspected within 3 years, and that the entire tunnel be reinspected within 10 years. Inspection of the Crystal Springs Bypass Tunnel will require shutdown of the Pulgas Tunnel and effectively cutoff water supply from Hetch Hetchy to the Peninsula customers and City of San Francisco. Inspection will need to be carefully planned out to minimize service disruptions. This inspection can be included in the pipeline inspection schedule, but it may not be in 2021 due to various system constraints.

Crystal Springs Pipeline No. 3 (P49 to L59K – 2.54 miles)

The 60-inch PCCP was installed in 1987, and was inspected in November 2017. Electromagnetic inspections were performed by Pure Technologies. The inspection showed the pipeline to generally be in good condition.

San Andreas Pipeline No. 1 (P10 to Baden – 2.17 miles)

This 44-inch riveted steel pipe with cement mortar lining was installed in 1898, and was inspected in November 2017. The pipeline was relined in 1977. Due to access issues, only a limited section of the pipeline was inspected. A more comprehensive inspection is being planned using an acoustic tool with a closed-circuit television video camera that can detect leaks and provide a visual to the interior of the pipeline.

Calaveras Adit 1 (Reservoir to Outlet Tower)

The Calaveras Adit 1 is a 48-inch, concrete, horseshoe-shaped tunnel, with concrete lining. It was originally installed in 1947, and was inspected in December 2017. An inspection was performed by a diver. Cracks in the concrete lining were found, and repairs were recommended.

Upper Alameda Creek Diversion Tunnel (Upper Alameda Creek Diversion Dam to Calaveras Reservoir – 1.85 miles)

This 5-foot 6-inch by 6-foot 6-inch concrete-lined tunnel was constructed in 1931, and was inspected in January 2018. The inspection found areas where the tunnel's concrete lining was missing and voids had formed. Further analysis is needed to determine repair needs.

Pipeline Inspections Planned for FY19 and FY20

The following are scheduled inspections for FYs 2019 and 2020:

- SAPL No. 2 (Steel) R20 to R50;
- SAPL No. 2 (Steel), R60 to CDD;
- Crystal Springs Bypass Pipeline (PCCP), G34 to G41;
- Balancing Reservoir Pipeline (PCCP), all;
- BDPL No. 4 (Steel), D30 to D40;
- BDPL No. 3 (Steel), C30 to C40; and
- BDPL No. 2 (Steel), B60 to B70.

The Hillsborough, Stanford, and Pulgas Tunnels have never been inspected but are expected to be inspected in 2019, 2020, and 2024, respectively. The 20-year pipeline inspection schedule is provided in Appendix C-2.

4.2.3 Valve Exercise Program

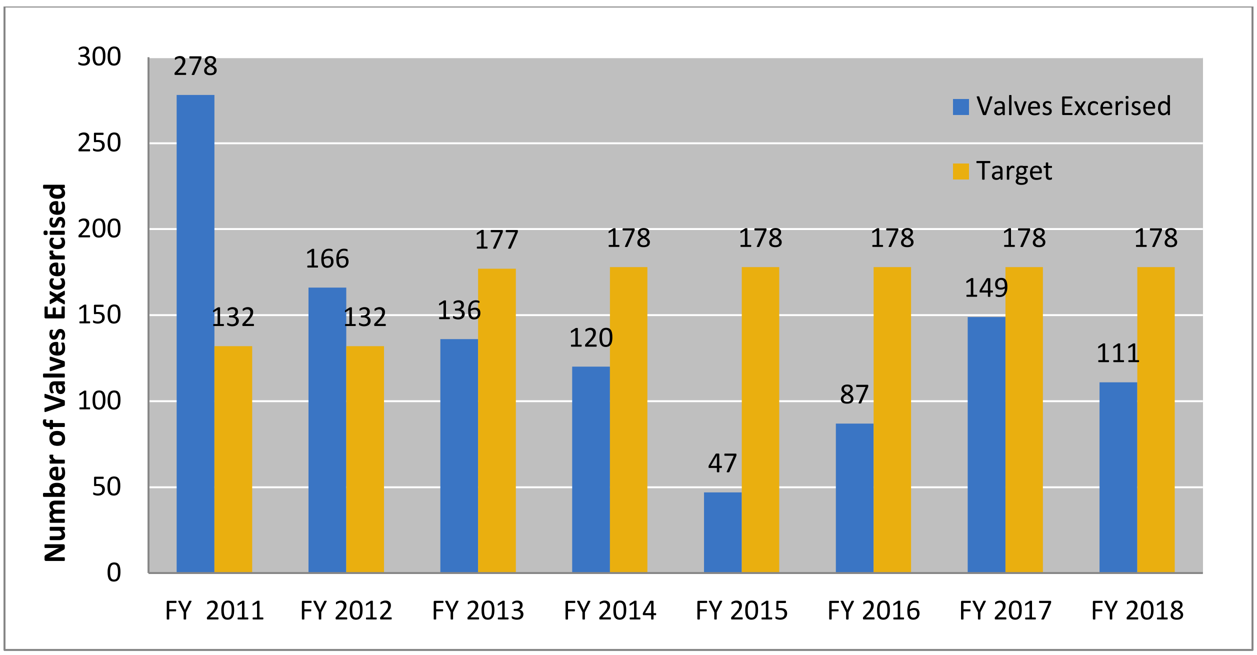
The valve exercising and maintenance program was enhanced in 2008 to extend the life of installed valves. These enhancements to the maintenance program were developed after the condition of several large line valves deteriorated in less than 10 years, due to a combination of improper operation, poor maintenance, and improper valve material specifications. See Figure 2-5 for an inventory of valves installed by decade. The valve exercise program is designed to extend the useful life of valves, increase reliability, and reduce life-cycle costs. The valve exercise program is based on specifications outlined in the valve manufacturer's O&M Manual, and on BMPs. The O&M manuals and BMPs define the level and frequency of maintenance required. The valve exercise program is completed using the Watershed Keepers, Utility Plumbers, and the Machine Shop crew. The goal of this program is to assess the condition of the valves, actuators, and appurtenances, as well as exercising the valve to determine operational capabilities and reliability.

The transmission program is designed to ensure that all valves are exercised at least once every 2 years (line valves and cross-over valves), with some HHWP valves being exercised quarterly. This program is largely completed by the plumbing/maintenance crews. If full operations of the valve will not disrupt system operations, the valve to be exercised is fully opened and closed. If full operation of the valve is not possible due to operational constraints, the valve to be exercised is "bumped," i.e., opened (or closed, if already open) at approximately 10 to 15 percent, then closed (or returned to fully open). The first 2 years of the valve exercise program (2009 and 2010) adopted a higher-than-standard rate (once per year) to reduce the backlog of valves that had not been exercised in years. In 2011 and 2012, the objective was reduced to be consistent with American Water Works Association (AWWA) standards, now that most valves have been addressed. The objective of exercising each valve at least once every 2 years continues today. Continued priority will be given to valve-exercising efforts as the need to support WSIP-related pipeline and warranty inspections diminishes.

Prior to WSIP completion, there were 264 valves in the transmission system (not counting the valves along the SJPLs). With completion of BDPL No. 5, new BDPL Nos. 3 and 4 cross-over vaults, Alameda Siphon No. 4, and SAPL No. 3 extension, the number has now increased to 356 valves (not including valves on the SJPLs and at the treatment plants). Figure 4-2 shows that the current target for WSTD is to exercise 178 valves every year, or 356 valves every 2 years. Only WSTD valves are shown in the figure.

As shown on Figure 4-2, the valve exercise rate has not significantly increased, due to extended WSIP pipeline and warranty inspections. In FY17 and FY18, the valve exercise rate and the pipeline inspection effort increased as activities related to WSIP warranty inspections ended.

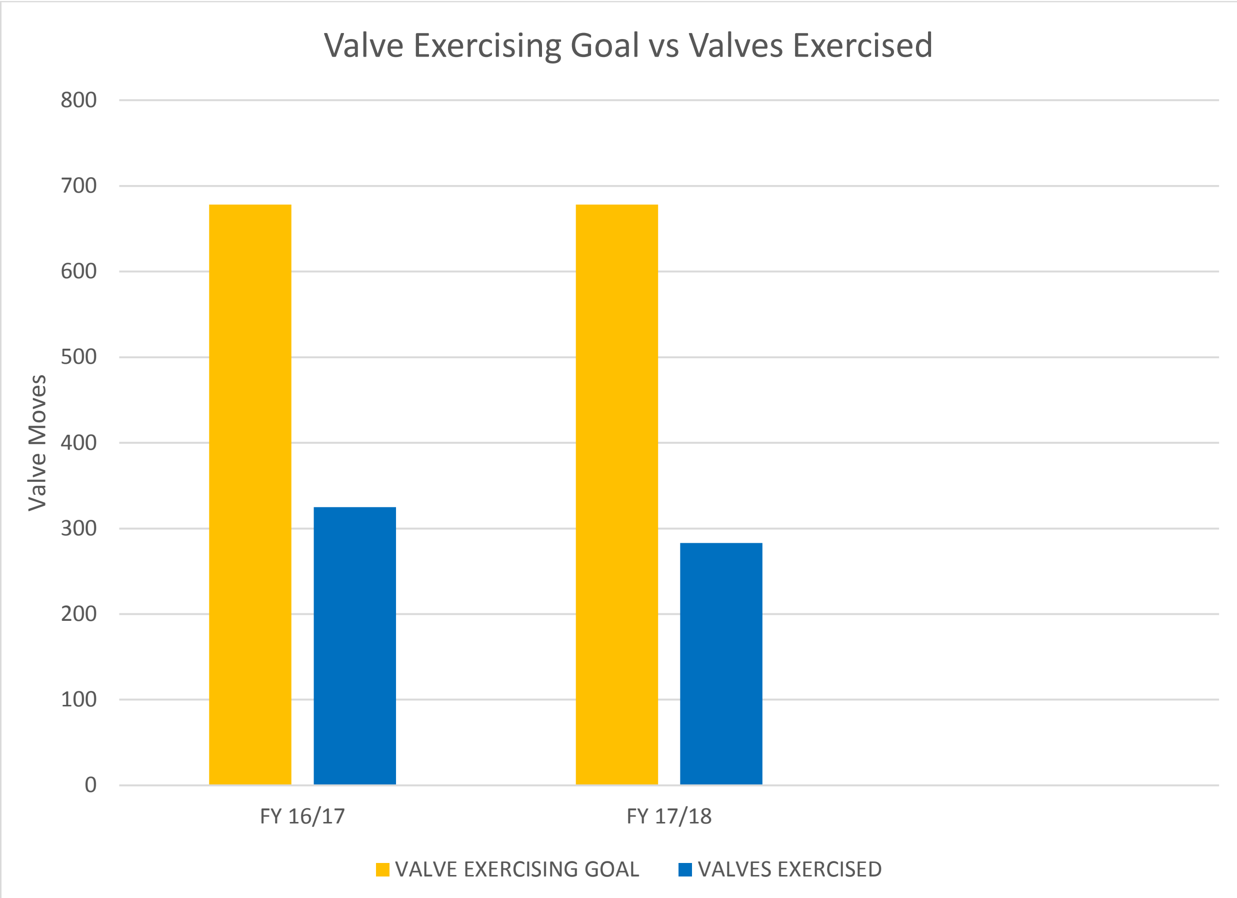
Figure 4-2: Number of Valves Exercised at WSTD from 2011 through 2018



The other valve exercise program component addresses critical operations valves housed in water treatment facilities that are exercised and maintained by operations staff. Most valves are routinely operated in the course of daily operations. A program for exercising valves not in regular operation is still pending.

HHWP has a similar valve exercise program. As shown on Figure 4-3, HHWP is not meeting their target. In 2019, HHWP will create schedule focus for completion of valves exercised by taking advantage and documenting the exercising of valves prior to rate changes or performing lock-out-tag-out. Similarly, if full operations of the valve will not disrupt system operations, the valve to be exercised is fully opened and closed. If full operation of the valve is not possible due to operational constraints, the valve to be exercised is bumped. Though not tracked in Maximo, it is estimated that about 50% of the valves exercised were bumped. HHWP has modified their preventive maintenance Maximo work order to include whether the valve was fully exercised or bumped.

Figure 4-3: Number of Valves Exercised at HHWP in 2017 and 2018

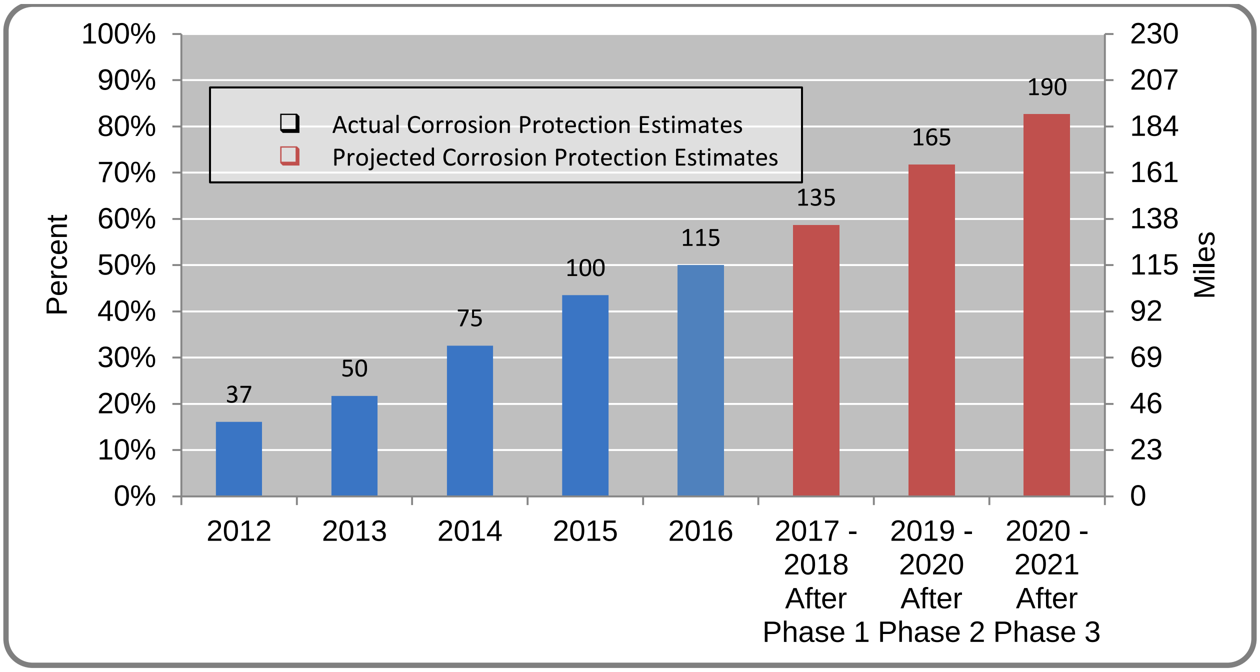


4.2.4 Corrosion Monitoring/Maintenance Program (FY18)

The corrosion protection program is one of the cornerstones of the SFPUC's asset management and PM efforts. Investments in the program are cost-effective, greatly extend the useful life of buried assets, and reduce unplanned outages. In FY10, the SFPUC and Schiff Associates updated the corrosion master plan. The primary objectives of the effort were to update the state of the corrosion protection system for buried assets in the Bay Area.

Prioritized projects derived from the plan were then sequenced in the CIP over 8 years. The master plan first assessed transmission pipelines to determine the adequacy of corrosion protection of the existing system. Then the master plan made recommendations to repair inadequacies and provide improvements for ideal corrosion protection. The cost of repairs and improvements was estimated to be between $18.3 and $22.1 million in 2010. WSTD started implementing the recommendations in FY11, and will continue to complete the repairs and improvements over the next 10 years. Projects that save the most money and protect the longest stretches of assets are implemented first. The scope of work is implemented over many years to reduce operational, construction, and staffing conflicts. Figure 4-4 summarizes the progression over time of CP on WSTD transmission pipelines.

Figure 4-4: Cathodically Protected Transmission Pipeline[19]



The 2010 corrosion master plan identified corrosion potential and vulnerabilities from local ground conditions (corrosive soil, stray current, etc.) on 230 miles of transmission pipelines. With these field data, the study determined the adequacy of existing corrosion protection systems. Using those results, the study determined additional corrosion protection projects (including maintenance and monitoring work) that would most effectively and efficiently extend the remaining useful life of pipelines and buried assets.

In 2010, the condition assessment performed as a part of the master plan found that existing CP systems on the WSTD transmission lines were operating at less-than-adequate levels. Of the cathodically protected pipelines, only 15 percent of the linear length was adequately protected; the remaining 85 percent received only partial to no protection, leaving the pipeline subject to corrosion. Note that since the implementation of the 2010 corrosion master plan, CP of the transmission system has improved 5 to 10 percent annually.

Based on the analysis, many of the pipelines in the peninsula and south bay are subject to stray currents. This phenomenon is typically the result of direct current (DC)-powered light-rail transit systems, or one of the numerous other buried utilities applying CP in the vicinity of WSTD pipelines.

The report also indicated that the bulk of the pipeline alignments were installed in corrosive soils. The soil corrosivity is of concern due to age of the infrastructure; specifically, that as pipeline coatings age they begin to deteriorate, exposing pipeline steel where corrosion is likely to occur. The more corrosive the soil, the higher the corrosion rate will likely be, resulting in exacerbated metal loss or loss of pipeline wall thickness.

[19] Does not include SJPLs.

Remediation of existing CP systems and conducting extensive studies at the areas identified in the report are relatively inexpensive when compared to construction costs of structures such as pipelines and pump stations. Projects were categorized by the type of corrosion protection (for example, electrical isolation) and by pipeline to bring the transmission system to an ideal protected state against corrosion.

Information is gained from planning efforts such as results of internal pipeline inspections, liquefaction conditions, locations of earthquake fault zones, criticality of particular pipelines to the Bay Area delivery capacity, adopted LOS, and, to some extent, the adjacent land use and associated liabilities (i.e., public safety and claims) in the event of a pipeline leak or failure. This information is then used in conjunction with the results of the corrosion protection program to guide and prioritize maintenance, R&R, and capital planning.

Implementation of corrosion protection projects also requires knowledge of concurrent maintenance or capital projects, because implementation costs are significantly reduced when pipelines are taken out of service for more than one purpose. Similarly, many recommended corrosion protection projects become unnecessary if assets will be replaced under the current capital program, such as the submarine sections of BDPL Nos. 1 and 2.

During FY13 and FY14, the SFPUC performed an in-depth analysis of the major external corrosion-related issues for all the transmission pipelines identified in the updated corrosion master plan. Detailed recommendations, including preparation of design and specifications, were provided for all necessary corrective actions.

Active corrosion protection program elements and recent accomplishments from FY17 are listed below, along with plans for FY18 and beyond.

Single-Line Diagrams

The Single-Line Diagrams for all major transmission lines were produced in FY14, which allowed SFPUC engineers to see all pertinent information for each pipeline system, such as insulated joints, rectifiers, test stations, bonding, cross-connections, foreign pipeline crossings, and pipe-coating systems. The information was first obtained from existing WSTD records and the updated master plan report. It was then verified with in-depth field analysis. The new Single-Line Diagrams are used to plan for new test stations and rectifiers, to correct the CP deficiencies for the pipeline system.

New Rectifier CP System

Rectifiers are used to convert alternating current (AC) power to DC power for CP systems. The negative terminal of the rectifier is connected to the pipeline, and the positive terminal of the rectifier is connected to the anode bed. A rectifier consists of a circuit breaker; diodes; and a step-down transformer with various coarse and fine taps for voltage adjustment.

In addition to renovating the existing rectifiers, the in-depth analysis identified additional CP systems that would be needed to bring the corrosion protection level of the underground pipelines up to the protection criteria established by the National Association of Corrosion Engineers. The CP system consists primarily of the rectifier and deep anode. During FY15, the SFPUC used field survey information obtained from the in-depth analysis to put together the

CP construction bid packages for installation of additional CP systems, which will be divided into three separate phases over 4 years, costing $9 million. Table 4-1 describes the three phases and their corresponding scopes.

Table 4-1: Cathodic Protection for WSTD Transmission Pipelines at Various Locations

Phase #/ Contract No.	Fiscal Year	Scope
Phase 1/Contract No. WD-2770	Design: FY15 – FY16 Construction: FY17-FY18	Provide and improve the level of corrosion protection for the following pipelines: CSPL No. 1, CSPL No. 2, SAPL No. 1, and SAPL No. 2. The pipelines are along San Francisco, Daly City, South San Francisco, San Bruno, and Millbrae. During Phase 1, 10 new rectifiers and approximately 45 new test stations were installed.
Phase 2/Contract No. TBD	Design: FY17-FY19 Construction: FY18-FY20	Provide and improve the level of corrosion protection for the following pipelines: Palo Alto; and BDPL Nos. 1, 2, 3, and 4. The pipelines are along Stanford, Menlo Park, Palo Alto, Los Altos, Mountain View, Emerald Hills, Newark, and Fremont. During Phase 2, there will be 15 new rectifiers and approximately 60 new test stations installed.
Phase 3/Contract No. TBD	Design: FY18 and FY19 Construction: FY20 and FY21	Provide and improve the level of corrosion protection for the following pipelines: Alameda Siphon Nos. 1 and 2, Calaveras Effluent and Influent lines, SSPL, and SVWTP Effluent line. The pipelines are along Sunol, Fremont, Hillsborough, Burlingame, Millbrae, South San Francisco, Colma, Daly City, and San Francisco. During Phase 3, there will be 18 new rectifiers and approximately 50 new test stations installed.

Notes:
BDPL = Bay Division Pipeline
CSPL = Crystal Springs Pipeline
FY = fiscal year
SAPL = San Andreas Pipeline
SSPL = Sunset Supply Pipeline
SVWTP = Sunol Valley Water Treatment Plant
TBD = to be determined
WSTD = Water Supply and Treatment Division

The first phase provided 10 additional rectifiers with deep anodes to the transmission pipelines between San Francisco and Millbrae. Also in the first phase, 45 additional test stations were installed along the pipeline alignments, to accommodate the upcoming pipe-to-soil potential surveys (originally, 80 test stations were planned, but there has been some resistance from local agencies to issue permits along their ROWs). Although fewer test stations translate to more time spent on performing corrosion surveys, the overall corrosion protection of the pipelines is not compromised, due to the protection provided by rectifiers and anodes. Construction for the first phase has been completed and the project team is currently working on as-built drawings. The second and third phases will follow with an additional 33 rectifiers and deep anode columns, which will cover transmission pipelines in the Peninsula and the East Bay. It is anticipated that 100 or more corrosion test stations will be installed as part of the second and third phases.

During FY17 and FY18, SFPUC staff coordinated with PG&E to study the power source locations for 15 new rectifiers for the second contract. SFPUC staff is coordinating with local jurisdictions (Redwood City, Menlo Park, Mountain View, Los Altos, Newark, and Fremont) to procure the permits needed to install the rectifier cabinets on the city sidewalks, anodes and test stations on city streets, and cable connections from the Phase 2 pipelines to the CP systems. The SFPUC developed the design drawings and specifications for the bid package to construct the 15 new rectifiers and 60 new test stations. For FY19 to FY20, the SFPUC will develop the design drawings and specifications for the third phase.

During FY16 to FY17, the SFPUC performed a biennial survey to evaluate the existing state of the CP system and determine whether any remedial action is necessary for the corrosion control of the transmission pipelines. For FY18 to FY19, the SFPUC will continue to perform the biennial survey to confirm that the CP system is still providing the expected protection level, and to continue making adjustments to the CP system as needed.

New Remote Monitoring Units to Monitor Rectifiers

The remote monitoring units (RMU) allow the SFPUC to remotely monitor the entire CP rectifier system via the Internet. Alarm parameters can be set to notify staff via email or text message in case of loss of AC power, out-of-range pipe-to-soil potentials, out-of-range current output, etc. Once the notification is received, staff will be able to remedy issues at each rectifier. Without the RMUs, staff would need to physically visit each site to manually read this information. The SFPUC installed 10 more RMUs in FY18 to monitor the new rectifiers installed in the first contract. There are 49 existing RMUs that monitor the existing rectifiers currently providing CP for the transmission pipelines. During FY17 and FY18, 12 RMUs required routine maintenance, such as replacing batteries and blown fuses. In FY18, eight RMUs will be replaced to match the current RMU models that contain updated control boards and new antennas that will fit into a smaller box. The routine maintenance with RMUs is being addressed by corrosion consultants. In general, RMUs have performed in accordance with the design.

CP Test Stations

CP test stations are essential for providing an easily accessible above-ground direct connection point to the pipelines for corrosion surveys. The test station typically consists of two wires, bonded to the pipeline underground and terminating on a test board either in a box flush to grade or on a post. It is important to have the test stations at regular intervals along the pipeline alignment for survey efficiency. The SFPUC installed 45 new test stations in the first contract in FY18. About 60 new test stations are planned for the second contract in FY19 to FY20.

Pipeline Isolation/Continuity

Pipeline isolation and pipeline continuity are critical elements to establish the limited boundaries of CP. To effectively achieve the adequate levels of CP, protected pipeline segments must have continuity (through welded joints or bonding cables) from one piece of pipe (generally 40 feet long) to the next. The ends of the protected segment must be isolated using insulating flange kits. When these elements are not properly installed or when they fail, repairs (mostly through repairing the insulated flange joint) must be done before CP can be applied effectively. In rare instances, replacement of a gasket is needed, which requires dewatering the pipeline. Additional joints will be restored as needed to accommodate a new CP design system.

Corrosion Surveys

For the next 8 years, a pipe-to-soil potential survey for each transmission pipeline will be performed every 2 years. The pipe-to-soil potential survey will indicate whether the level of CP is adequate. The survey will also reveal whether field conditions have changed from the previous survey or whether CP interference is occurring in the field. The rectifiers are normally adjusted by changing the coarse and fine taps of the step-down transformer during the pipe-to-soil potential survey, to compensate for changes in the field conditions. After getting the existing CP systems back to an adequate corrosion protection level through the first three contracts, the biennial corrosion surveys will continue to be performed to determine how the system is working and what additional CP upgrades or repairs are needed.

HHWP Corrosion Control

HHWP's CP program has been in place on portions of the SJPL system since 1980. In FY14, the SFPUC updated their Cathodic Protection Manual (CPM) with the Cathodic Protection Manual-San Joaquin Valley Pipeline. The primary objectives of the effort were to document the existing system and to establish a plan for improvements moving forward. The CPM is also used as a guide to manage, maintain, monitor, and improve the CP system for the SJPLs. The CPM used data from previous SJPL inspections, including the San Joaquin Valley Pipelines Condition Assessment (SJCA) Phase III, June 2014. The SJCA was an investigative effort by HHWP to document the various locations of the existing condition of the SJPLs where corrosion is likely to occur due to environmental factors/conditions or pipeline coatings. HHWP continues to rehabilitate and extend their CP coverage. During the last 2 years, HHWP installed four new rectifiers at the CP facilities, and rehabilitated the grounds.

4.2.5 Cross-Connection Mitigation for Transmission Pipeline Appurtenances

The WQD is responsible for management and implementation of CCSF's cross-connection controls program, in compliance with all applicable regulations and standards. The California Waterworks Standards, including cross connection prevention requirements for air valves and blow off valves, went into effect in 2008. The Waterworks Standards apply to new facilities and existing facilities requiring repairs (most SFPUC pipelines were built well before the Waterworks Standards, some as far back as the 1920s). Since the Waterworks Standards went into effect, the SFPUC has been focused on WSIP implementation. As part of WSIP implementation and Waterworks Standard compliance, the SFPUC developed standard drawings for regional system Air-Vacuum Valve (AVV) and Blow-off (BO) vaults, and referenced them in specifications in WSIP as well as CIP contract documents. With WSIP winding down, the SFPUC proactively and voluntarily implemented the regional cross connection control assessment program to address old facilities (i.e., pre-Waterworks Standards facilities that have not had any major repairs). After completion of the regional pipelines appurtenances site assessments, we will start an assessment of the regional water system upstream of Alameda East (i.e., San Joaquin Pipelines).

In 2016, the WQD initiated a collaborative cross-connection control project with WSTD as a proactive approach to reduce risks of potential cross-contamination to protect public health. The project objective is to ensure that all the appurtenances in the RWS—including air vacuum valves (AVVs), air release valves (ARVs), blowoff valves (BOs), and the vaults that house these appurtenances—are in compliance with the current regulations and standards. The applicable regulations and standards are:

- California Code of Regulations (CCR), Title 17, Sanitation;
- CCR, Title 22, Waterworks Standards;
- AWWA Manual of Water Supply Practices M-51;
- AWWA Standard C512; and
- WSTD Standard Drawings.

The regulations require that the AVVs and ARVs in the RWS are installed so that the vent opening is above grade; above the calculated 100-year flood water level; readily accessible for maintenance; constructed and designed to prevent exposure to rainwater or runoff, vandalism, and birds, insects, rodents or other animals; and fitted with a downward-facing screened vent or a domed and screened cap.

The RWS includes more than 230 miles of pipeline and tunnel that transmit potable water to wholesale customers, and is fitted with more than 1,700 installed appurtenances of various sizes, types, functions, and periods of installation throughout the East Bay, South Bay, and Peninsula. Many new appurtenance vaults have been added in the last 10 years as part of the WSIP. The scope of cross-connection project includes:

- review of applicable regulations, and AWWA and SFPUC standards;
- development of checklists and templates for field assessment surveys;
- visual field assessments of all appurtenances and related vaults;
- identification of mitigation requirements and development of recommendations;
- grab field sampling of accumulated water in vaults, as needed;
- identification of inconsistencies in the current database of appurtenances and GIS;
- assessment reporting for each pipe segment; and
- implementation of mitigation measures for identified appurtenances, and revision of documents accordingly.

Due to the large number of appurtenances and pipelines in the RWS, the pipelines were grouped and prioritized for field assessment starting with the longest pipeline segments to obtain representative data. Table 4-2 lists the tentative pipeline assessment and prioritization schedule, which is subject to later refinement, depending on the number of appurtenances, upcoming assessment findings, future shutdowns, site accessibility, resources availability, mitigation progress, weather conditions, and any unforeseeable factors.

Table 4-2: Prioritization and Schedule for Cross-Connection Pipeline Assessment and Mitigation

Pipeline Segments	Field Assessment – Tentative Schedule	Mitigation – Tentative Schedule
BDPL Nos. 3 and 4	February 2016 through March 2017 (Completed)	September 2017 through July 2020
BDPL Nos. 1, 2, and 5	April 2017 through July 2018 (In Progress)	July 2020 through February 2021
CSPL Nos. 2 and 3, and SSPL (Up to Baden)	August 2018 through July 2019	February 2021 through June 2022
Sunol Region	August 2019 through October 2019	June 2022 through October 2022
Palo Alto Pipeline	October 2019 through December 2019	October 2022 through February 2023
CSSAPL	January 2020 through March 2020	February 2023 through June 2023
SAPL Nos. 1, 2, and 3	April 2020 through March 2021	June 2023 through June 2024
CSPL Nos. 2 and 3, and SSPL (Remaining)	April 2021 through February 2022	June 2024 through March 2025

Notes:
BDPL = Bay Division Pipeline
CSSAPL = Crystal Springs San Andreas Pipeline
CSPL = Crystal Springs Pipeline
SAPL = San Andreas Pipeline
SSPL = Sunset Supply Pipeline

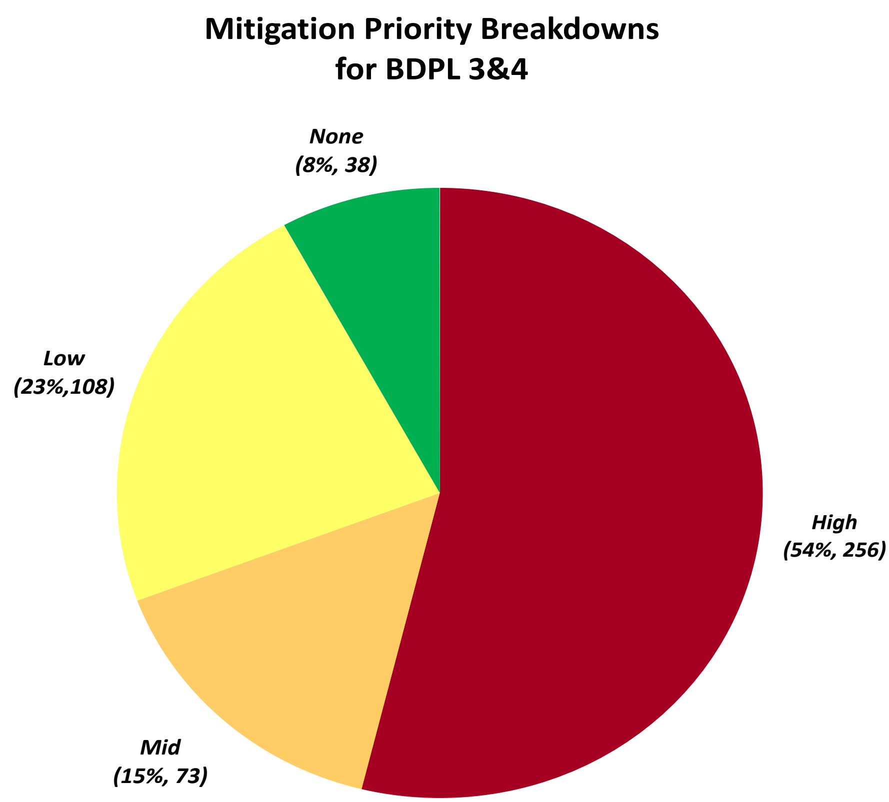
After assessments are complete, the approach includes prioritization of the mitigation recommendations using a risk-based approach. In general, appurtenances are deemed high risk when there is a relatively high probability of water level reaching the valve opening inside the vault. Priority levels include:

- **High Priority:** The AVV is below the riser's vent; the BO blind flange is not installed; or the BO does not have air gap.
- **Medium Priority:** The AVV overflow rim is in the middle of the riser's vent; or the riser vent does not maintain a minimum of 6 inches of clearance above grade.
- **Low Priority:** The AVV overflow rim is above the riser's vent but missing items like bug screens; or the gate valve on the BO is not certified by NSF (formerly known as the National Sanitation Foundation).
- **None:** Meets requirements.

The initial set of pipe segments selected for assessment were BDPL Nos. 3 and 4, a pair of parallel pipelines, approximately 34 miles long each, ranging from 72 to 97.5 inches in diameter. These pipelines convey drinking water from the East Bay to the Peninsula. The site inspections and the assessment report for appurtenances of these pipelines were completed in 2017. The report includes appurtenance information; noncompliance findings; FEMA's 100-year flood level, where applicable; and mitigation recommendations. The report also lists appurtenances that do not meet the current regulations and standards; that are vulnerable to flooding due to urban development; and that have been added, removed, or modified and do not match reference data from GIS and the CMMS software used by the SFPUC (MAXIMO).

The initial site assessment surveys found that BDPL Nos. 3 and 4 has 475 appurtenances installed, 175 more than are listed in MAXIMO. As shown in Figure 4-5, 54 percent of the appurtenances are high priority; 15 percent are medium priority; and 23 percent are low priority, not meeting the current regulations and standards, given that these pipelines were built in 1952 and 1973, respectively.

Figure 4-5: Mitigation Priority Breakdowns for BDPL Nos. 3 and 4



The knowledge gained from the initial appurtenance assessments is very useful for understanding compliance status, asset management, and records cleanup; and for engaging other internal stakeholders—such as the WSTD (O&M) and NRLMD (Watershed ROW) departments—for corrective actions.

WSTD has initiated mitigation measures, which include raising existing vaults, installing and replacing vault covers, raising existing air valves, adding "goosenecks" to existing air valves, lowering surrounding grades, and installing bug screens to air vents. Currently, the BDPL Nos. 3 and 4 mitigation work is progressing at a limited pace, primarily due to WSTD resource constraints (e.g. staffing limitations, prioritization of pipeline conditions assessment work, and routine maintenance). WSTD will hire a crew and dedicate it to implementing the work of this project as its top priority. Mitigation measures on BDPL Nos. 3 and 4 are planned to be complete by December 2019.

After assessment of BDPL Nos. 3 and 4, the project has continued on to appurtenance assessments of BDPL Nos. 1, 2, and 5, a set of parallel pipelines with more than 270 appurtenances. Assessment of this next set of pipelines is expected to be completed by August 2018. The next set of pipelines for field assessment will be CSPL Nos. 2 and 3 and SSPL in peninsula, which will begin in August 2018 and is expected to take about 1 year for completion.

4.2.6 Meter Improvement Program

The Bay Area relies on numerous flow meters to manage day-to-day operations. Meter data are used for system hydraulics analysis, tracking daily and longer-term water use, and computing system water balances. Meter data are also used for financial purposes by supporting the computations for wholesale and retail water use, which directly affects cost allocations between these customer classes. The objective of the meter improvement program is to comply with contractual requirements, increase meter accuracy, increase reliability (reduce data drop-outs), standardize installations, and lower maintenance costs by reducing emergency call-out repairs.

The meter improvement program implements calibration and maintenance requirements outlined in Appendix J of the 2009 Water Supply Agreement (WSA). The program focuses on more than 40 meters. For the FY17 and FY18 period, more than 140 calibrations were performed. RWS meters are generally organized into four categories: system input/output meters, in-line meters, county-line meters, and terminal storage meters. Significant detail on these meters, including inventory, required maintenance, and calibration, can be found in the 2009 WSA. All the meters are regularly calibrated through an independent metering consultant.

The San Francisco/San Mateo county-line meters are a priority of the program due to their role in wholesale revenue requirement cost allocation. Table 4-3 lists the FY17 and FY18 calibration frequency of the county-line meters. The program ensures regularly scheduled calibrations and as a result has returned more consistent and reliable readings, as shown on Figure 4-6.

Figure 4-6 shows that over the 2-year period covered in this report (FY17 and FY18), all meters were found to be within the 2 percent requirement of the 2009 WSA. By practice, whether or not a meter is found to exceed the calibration criteria, the independent meter consultant inspects the components, flushes lines, and conducts a repeat test on the same day.

Maintenance of the meters includes regular cleaning and replacement when parts reach approximately 80 percent of the expected usable life. Proactive replacement of meter components greatly improves calibration and meter accuracy.

Each year, meter installations are evaluated for upgrades and improvement as part of the calibration routine. County-line meters are a priority, due to their role in wholesale revenue requirement cost allocation; consistent quarterly calibrations and maintenance ensure that meter equipment is upgraded as needed, thereby reducing the frequency of meter failure or poor performance. Equipment replacement in FY15 through FY18 is presented in Table 4-4.

Table 4-3: FY17 and FY18 San Francisco/San Mateo County Line Calibration Summary

FY		Date	CSPL No. 1	CSPL No. 2	SAPL No. 2	SAPL No. 3	SSPL (LMPS)	Sutro Pipeline (LMPS)	Total Per Quarter
FY17	1st Quarter	July 2016							6
		August 2016							
		September 2016	✓	✓	✓	✓	✓	✓	
	2nd Quarter	October 2016							4
		November 2016							
		December 2016	✓	✓	*	*	✓	✓	
	3rd Quarter	January 2017			✓	✓			6
		February 2017							
		March 2017	✓	✓			✓	✓	
	4th Quarter	April 2017					✓	✓	6
		May 2017		✓					
		June 2017	✓		✓	✓			
FY18	1st Quarter	July 2017							6
		August 2017							
		September 2017	✓	✓	✓	✓	✓	✓	
	2nd Quarter	October 2017							6
		November 2017							
		December 2017	✓	✓	✓	✓	✓	✓	
	3rd Quarter	January 2018							4
		February 2018							
		March 2018	✓	✓	✓		✓		
	4th Quarter	April 2018				✓		✓	8
		May 2018			✓		✓	✓	
		June 2018	✓	✓		✓			
Total Calibrations for FY17 and FY18			8	8	7	7	8	8	46

Notes:
✓ = Calibrated
* = Site Construction No Access
FY = fiscal year
CSPL = Crystal Springs Pipeline
LMPS = Lake Merced Pump Station
SAPL = San Andreas Pipeline
SSPL = Sunset Supply Pipeline

Figure 4-6: San Francisco/San Mateo County Line Calibration History FY11 to FY18

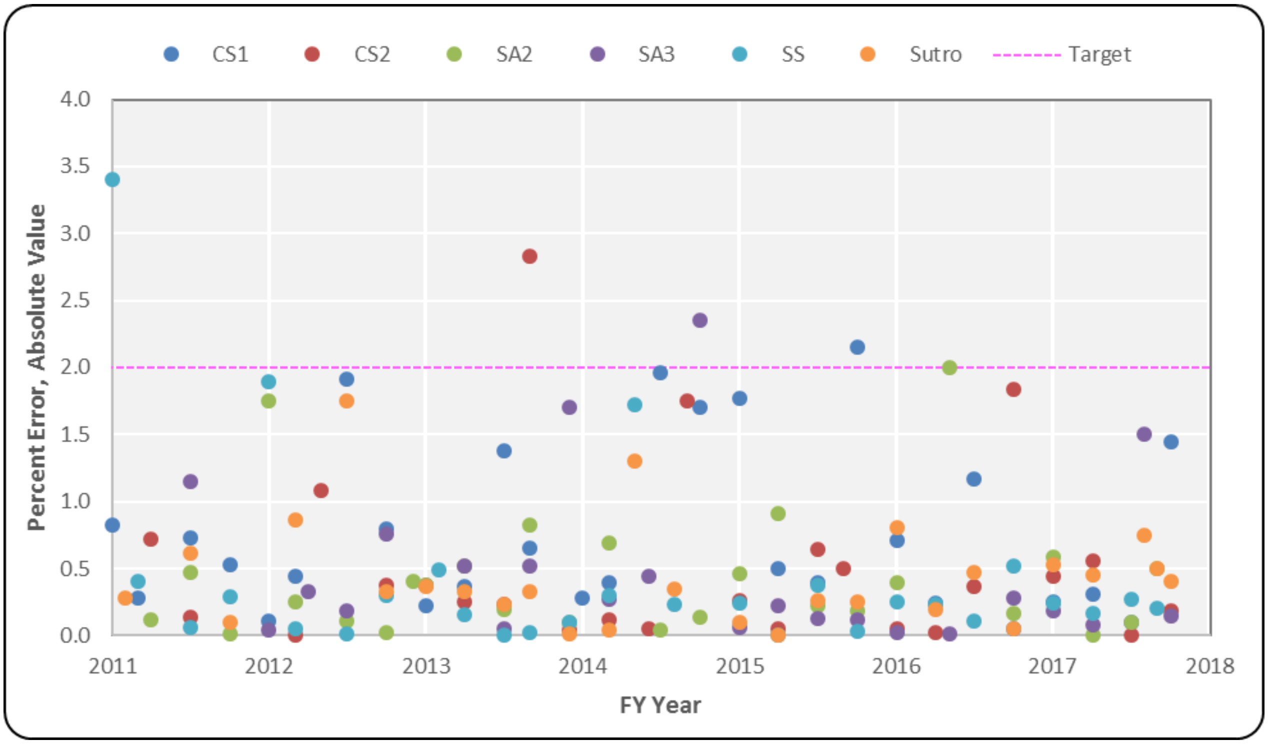


Table 4-4: Summary of Meter Equipment Replacement, Installation, and Improvement

J Table Meter Program: Equipment Replacement / Installation / Improvement							
FY	Meter	D/P Transmitter & Related Plumbing	Data Logger	Pitot Tap	New Meter / Level Transmitter	Improve Meter Loop Wiring	Improve Instrument & SCADA Installation
FY15	San Andreas #2 Meter Co Line						✓
	University Mound Res Level				✓	✓	
	HTWTP TWR Effluent Meter				✓		
	San Antonio Fwd-Rev Meter		✓				
	Bay Division PL Pulgas #5 Meter		✓				
FY16	Crystal Springs #1 Meter Co Line						✓
	LMPS Sunset-Sutro Intertie						✓
	HTWTP TWR Effluent Meter			✓			
	Bay Division PL Pulgas 1 & 2		✓				
	Bay Division PL Irvington 1, 2 & 5		✓				
	Bay Division PL Irvington #5 Meter			✓			
FY17	Sutro LMPS County Line	✓					
	SVWTP Effluent Meter			✓			
	University Mound Res Level				✓	✓	
	San Antonio Fwd Meter	✓					
	San Antonio Rev Meter	✓					
	Pulgas Dechlor Open Channel				✓		
	Albers Road Meters 1, 2, 3		✓				
FY18	Crystal Springs - San Andreas FM	✓					✓
	New Crystal Springs By-Pass Tunnel						✓
	Crystal Springs #2 County Line	✓				✓	

Notes:
BDPL = Bay Division Pipeline
CSPL = Crystal Springs Pipeline
D/P = differential pressure
FM = Force Main
FY = fiscal year
HTWTP = Harry Tracy Water Treatment Plant
LMPS = Lake Merced Pump Station
SAPL = San Andreas Pipeline
SCADA = Supervisory Control and Data Acquisition
SVWTP = Sunol Valley Water Treatment Plant
TWR = Treated Water Reservoir

Regional Water System Water Balance Computation

Reliable and accurate meters are necessary to support customer billing and computation of the wholesale revenue requirement. Additional meters are used to compute the system water balance. Over the last 6 years, the annually calculated inflow into the water system has been within 1.4 percent on average of the output (output defined as sales to customers, including San Francisco). Results from FY18 are pending. This result suggests that overall system losses are likely small. However, in reality, system losses are certainly nonzero, and inflow into the system in some years is *less* than outflow, which suggests some level of meter error in the calculation. Over the last 6 years, output exceeded input in two of those years. As discussed in prior reports, the accurate measurement of spillage into Crystal Springs Reservoir is thought to be a primary point of measure for ensuring a positive water balance where input exceeds output. The installation of a new meter measuring spillage into Crystal Springs Reservoir is proving a more accurate measure of discharges than the prior weir-measuring method. Although the improved measurement of spillage into Crystal Springs has not eliminated the occurrence of output exceeding input, the frequency of such occurrences has decreased when compared with years past.

Automated Meter Infrastructure

In FY18, new AMI meters were installed at all but two wholesale meter services. The remaining two services to receive AMI require a significant construction upgrade of the service to facilitate AMI, and this project is expected to be completed within the next 2 years. Coastside County Water District does not currently have AMI, due to the remote location of their service and corresponding poor cellular signal. The SFPUC regional AMI relies on cellular signal for data transmission.

The new AMI technology enables more immediate evaluation of usage and water balance analysis. With the availability of new AMI metering data, in combinations with ongoing meter calibrations and maintenance, the sources of potential errors are decreasing. Using AMI and system meter data in water balance analysis lessens the potential for errors, and can be used to identify potential errors and implement investigations and corrective action.

In fall of 2017, the SFPUC completed AMI upgrades at more than 99 percent of meters for the wholesale customer service connections. The AMI program allows customers to log in to a protected web -page to view their own water usage and track water deliveries from the SFPUC in near real time. In late 2017, the SFPUC retired the use of manual log books for recording wholesale customer billing meter reads and began using AMI-generated meter read reports for billing purposes.

FY18 and FY19 Planned Work

In addition to replacing aging equipment, the main focus for FY18 and FY19 will include the following:

- SA3 San Francisco/San Mateo County Line Meter: construct an improved accessway to the SA3 county line meter pitot tap location on the pipe bridge.
- Irvington Meters 1 and 2: install new pitot taps.
- Calaveras Meter: replace instruments and improve instrumentation layout.
- Complete AMI installation at two remaining wholesale customer service meters.

In prior years, a new San Francisco/San Mateo county-line meter on the SSPL upstream of the LMPS at Camp Ida (Girl Scout Camp) was contemplated. This work has been postponed and will be rescheduled for a future date.

4.2.7 Pump Stations

All major pump stations in the Bay Area region were partially or totally rebuilt as part of the WSIP.

Crystal Springs Pump Station

CSPS was completely replaced in September 2014. Scope for the project included upgraded seismic performance, modern switchgear and starters, and variable-speed pumps. Collectively, the operational upgrades permit more off-peak pumping and will lower electrical costs.

SFPUC staff designed and implemented an automatic pump control strategy. By pumping during off-peak hours, the SFPUC saves energy and reduces operating cost. The strategy is under consideration for use at other SFPUC facilities.

Baden Pump Station

Baden Pump Station improvements included installation of variable-speed pumps; installation of a new pressure-reducing valve to allow water from HTWTP (the high-pressure zone) to supply the low-pressure zone; installation of various valve improvements; seismic retrofit; and replacement of various piping segments, existing electrical components, and the transformer.

Design and construction of the replacement air compressor system was awarded and was completed before the January 2017 Hetch Hetchy shutdown. Additional site improvement work to improve grading will be needed in the future, but is not a high priority.

Pulgas Pump Station

At the Pulgas Pump Station, an isolation valve was replaced; stabilizing slope improvements were completed at the Pulgas Tunnel Air Shaft site.

San Antonio Pump Station

Under the WSIP, the SAPS was partially rebuilt, with work concluding in FY11. Improvements included replacement of the 1,000-horsepower electrical pump casings, addition of two 1.5-megawatt emergency generators, and seismic retrofit to ensure operator safety. In preparation for the LCA test in early 2015, the Water CIP funded further upgrades at SAPS by replacing one of three diesel-driven motors with an electrically driven one, along with related upgrades. These upgrades were already planned in the CIP. Preparing for the LCA test only expedited the reliability of SAPS. Additional work to replace components of the switchgear and motor-control center is underway in FY19. Seismic retrofit of the control room to ensure post-seismic life safety, as well as replacement of diesel engines (for operational redundancy), may be included as future CIP projects. Significant capital improvements even beyond what is currently scoped in the CIP will need to be considered for the Sunol Valley, due to the need for a pump station at that location, and due to the age of the current pump station (built in the 1960s). A new pump station inevitably needs additional power; this will likely lead to upgrades to the Calaveras Substation, which currently powers the entire Sunol Valley. Furthermore, performance requirements would need to be revisited with two criteria in mind: a) Calaveras Reservoir as a water source and b) HH aqueduct reliability to the Sunol Valley. A needs assessment will be initiated in the next FY along with initial planning discussions. The most obvious considerations would be replacing the diesel pumps, overhauling the electrical system, and possibly relocating the pump station off the Calaveras Fault. Those items would be evaluated in context.

Pond F3E (Sunol Valley)

The SABPL and Pond F3E Pumping Facility were successfully used to discharge water of unacceptable quality from the CRT inspection in January 2017, and again in March 2018. The water is captured in Pond F3E and sent to either San Antonio Reservoir or the SVWTP for treatment. In November of 2017, it was discovered that one of two submersible pumps installed at Pond F3E is not functioning. The pumping capacity was consequently reduced from about 6 mgd to 3 mgd. Service and investigation of the condition of the failed pump can take place in FY19, after erosion repair work is completed. After several winters of operating Pond F3E, there may be reason to investigate the stability of the side slopes of the pond. Otherwise, this WSIP upgrade is a useful tool that improves RWS reliability.

Of paramount concern to the SFPUC and the wholesale customers are the structural issues in the Mountain Tunnel (addressed in HHWP's capital plan). In preparation for the planned shutdowns to support construction, or for any unplanned shutdowns of the tunnel, the SFPUC developed a response plan that is being tailored to the 2019 Hetch Hetchy Shutdown. Additional planning has gone into managing local storage at higher levels to reduce risk to customers during the shutdown of any upcountry facilities.

Lake Merced Pump Station

LMPS improvements were completed in FY14, although an outstanding electrical problem has not yet been resolved. The new pump station was designed to resist fire, seismic, and other catastrophic events. Modern energy-efficient pumps and controls replaced existing equipment, and new emergency backup generators will ensure continuous station operations in case of power outage.

Eleanor-Cherry Pump Station

The Eleanor-Cherry Pump Station was built in the late 1980s to increase diversion from Lake Eleanor to Lake Lloyd. The system was designed with ten pumps and can divert almost 500 cfs when Lake Lloyd storage is high. Five of the ten pumps are not functioning. Lake Lloyd must be drawn down to 140,000 AF to perform maintenance on the pumps. Significant effort was made to have the pumps rebuilt during the recent drought, but a compliant, responsive vendor was not available. Attempts were made to purchase new pumps, but it was determined that the existing system should be redesigned and rebuilt. HHWP will propose a replacement project in the future capital plan. Power Enterprise capital projects are prioritized based on criticality (ability to deliver water), risk of failure and available funds. HHWP operates the system to optimize the reservoir carryover storage, regardless of whether these pumps are in service.Interties

Santa Clara Valley Water District Intertie

Staff worked with SCVWD employees and the Milpitas Fire Department to correct all regulatory compliance issues. During the 10-day March 2018 Hetch Hetchy shutdown, SCVWD Intertie provided the RWS with an average of 15 mgd.

4.2.8 Penstocks and Powerhouses

Kirkwood Penstock

Movement, tracked through the monitoring program, was within expected ranges until February 2007. At that time, the rate of movement increased, resulting in the partial failure of one fixed saddle directly below anchor block 2. Following the movement identified in 2007, HHWP contracted with Black & Veatch to collect additional survey information and interpret/ analyze available data; this effort was summarized in the Kirkwood Penstock Geo-Structural Assessment Report (December 2009). From 2010 through 2012, HHWP continued with the monitoring program. In 2012, HHWP again contracted with Black & Veatch, this time to perform a Risk Analysis to evaluate potential failure modes and associated consequences. In 2014, HHWP completed a risk analysis that established strategies for the facility. External and internal inspections were performed in October 2015 and January 2016, respectively. The inspections established a baseline for future monitoring and confirmed that the lining and coating is in adequate condition. In 2017 and 2018, an improved monitoring system was installed, and emergency spare components (dresser couplings) were procured. The rate of movement of the penstock will continue to be monitored and evaluated, as needed. The risks since 2007 have been reduced, due to continuous monitoring.

Kirkwood Powerhouse

In 2016, HHWP inspected downstream of the valves and found debris. Further inspection revealed that the energy dissipater had failed, and that the floor of the discharge chamber had eroded away. During the 2017 shutdown, HHWP performed repairs on the discharge chamber, and installed a new energy dissipater. The bypass valves have been operational since, and an inspection following the new dissipater's use is scheduled for 2019.

Moccasin Penstock

HHWP performed an informal internal condition assessment of the penstock in 2006. Significant corrosion was found at the bifurcation where the penstock increases from two to four pipes. Further condition assessments found that:

- the anchor block at the bifurcation is unable to carry load;
- the pipe saddles are of poor quality;
- there is cause for concern regarding the integrity of the hammer-forged welded steel sections downstream of the bifurcation (longitudinal welds only);
- the concrete anchor blocks are deteriorating, due to alkali-aggregate reaction in the concrete;
- the coating and lining is in poor condition; and
- rivets have been lost at the pipe joints upstream of the West Portal butterfly valves.

A capital project will occur on penstock 1 to repair pipe saddles and replace sections above the bifurcation. Ongoing inspections of the water conveyance system between Priest Reservoir and Moccasin Reservoir may identify additional projects or a change in project priority that may impact projects identified in the 10-year capital plan. Overall, this is a reliability concern for the water supply which is the reason for HHWP to recommend the Priest-Moccasin Water Transmission Line.

Moccasin Powerhouse and Moccasin Lowhead Powerhouse

The facility suffered a catastrophic failure of buss-work in July 2017. This resulted in a shutdown of the powerhouse. Emergency repairs were performed, and the powerhouse was returned to service in December 2017. The Moccasin Powerhouse and generator step-up transformers are scheduled to be rehabilitated/replaced in the 2018, 10-year capital program.

Each power-generating unit has a bypass valve that allows water to flow without the generating unit in service. In 2017, Unit 1's bypass was found to have broken mounts on the actuator. HHWP performed temporary repairs to allow operations of the valve, if necessary. Manual operation of the bypass valves was restored in April 2018. A project to automate the operation of the bypass valves is currently underway, and will be completed in 2018. This project replaces the actuators, and will allow for remote operations from the Moccasin Control Center.

A proposed facility, the Priest-Moccasin Water Transmission Line, will allow bypassing of the Moccasin Powerhouse. The 300-mgd-capacity water transmission line, with energy dissipater, will be constructed from West Portal Valve House to Moccasin Reservoir, paralleling the Moccasin Penstocks and bypassing the powerhouse. It is anticipated that a decision will be made in October 2018.

Moccasin Lowhead Powerhouse was taken offline when the Moccasin isolation transformer failed in 2016. The lead time for transformers is 30 months, and the project will be completed in 2018. In addition to the new isolation transformer, the failed transformer was rewound, and will be used as a spare. The Moccasin Lowhead is unreliable, and requires rehabilitation. HHWP will propose improvements in the next capital plan.

4.3 Water Treatment

Maintenance and renewal/replacement for six major treatment facilities is covered by this program: HTWTP, SVWTP, SVCF, Pulgas Dechloramination Facility, TTF, and Thomas Shaft Chlorination Station. With the exception of the SVCF, each has undergone some form of capital upgrade as part of the WSIP, with work completing this FY at HTWTP. The San Antonio, Baden, Pulgas, and Crystal Springs pumping stations are also included in this program, because the same staff operate and manage them.

Approximately 3 miles upstream of the SJPLs is our seventh major treatment facility: Rock River Lime Plant. The Rock River Lime Plant doses Hetch Hetchy water deliveries to the RWS with hydrated lime to raise the pH and alkalinity of the water for SJPL corrosion control. Dry quicklime (CaO) is stored onsite in silos and mixed with water in slakers to hydrate the lime $Ca(OH)_2$. The hydrated lime is diluted to a milk-like slurry that is applied to the water flowing in the Foothill Tunnel of the Hetch Hetchy Aqueduct. Lime is delivered to the site by bulk carrier tractor/trailers. The plant has been in operation since 1953. In FY17, temporary injection lines were put into operation to replace the existing corroded injection lines. Installation of new permanent injection lines is planned for FY19.

The most significant work to report in FY17 is maintenance improvements that were made to chemical piping leading up to the 62-day Hetch Hetchy shutdown in January and February of 2017. Major chemical feed systems for hypochlorite, ammonia, and caustic were upgraded at the

SVCF. The SVCF has been in continuous operation for 15 years. The extreme temperatures in the Sunol Valley, coupled with the corrosive nature of the chemicals, contributed to the need for replacement of the chemical feed system piping and components.

4.3.1 Maintenance at Operating Facilities

As with prior years, maintenance and renewal/replacement projects were otherwise limited, due to WSIP construction and staff availability. However, the highest prioritized work was completed, including warranty inspections for recently completed projects. Other notable FY17 and FY18 accomplishments are discussed below by facility.

Rock River Lime Plant

The Rock River Lime Plant is situated along Foothill Tunnel. The plant, which doses Hetch Hetchy water deliveries to the RWS with hydrated lime to raise the pH and alkalinity of the water for SJPL corrosion control, was rehabilitated in 2010 and 2011. In 2010, the facility was upgraded with rotary mixers, new feeders, and safety enhancements. The upgrade to rotary mixers allows more control at very low dosage rates. In 2011, the building was rehabilitated (new windows, interior stairs, and roof flashing were installed; and interior/exterior painting was done). In 2017, temporary piping was installed to deliver the slurry to Foothill Tunnel. The existing pipe works had become restricted due to buildup of lime inside. A permanent replacement of the pipe is scheduled for 2019.

Tesla Treatment Facility

Starting in mid-2017, the TTF Flywheel Uninterruptible Power Supply (UPS) Unit 8130 (one of three Flywheel UPS units) failed. The main function of the UPS units is to provide continuous power to the UV reactors during a utility power outage. The UVs disinfect the Hetch Hetchy water passing through the TTF, and ensure compliance with the SFPUC's drinking water permit requirements. The warranty periods for these items have expired and immediate action was necessary to address these concerns. The SFPUC entered into an emergency contract to minimize the UPS outage duration, and thereby minimized the risks of 1) a drinking water permit violation; 2) damage to sensitive data and communications systems; and 3) additional deterioration or breakdown of the other two UPS units. The emergency service work included replacing a number of components, including costly bearings and capacitors. A maintenance service contract is being put in place to avoid future emergencies on the UPS units.

Upcoming FY19 and FY20 work will include HVAC upgrades and feed adjustments to the carbon dioxide system.

Thomas Shaft

Thomas Shaft is the backup facility to TTF in dosing chlorine into the CRT. In addition to minor programming improvements, the sample pump system was refurbished in FY18.

Sunol Valley Chloramination Facility

The SVCF is the westernmost location for making chemical adjustments before water is delivered to the RWS wholesale customers. This was the only chemical facility that was not a part of a WSIP upgrade. In FY17 and FY18, chemical tank lining was replaced on the hypocholorite and ammonia tanks. A new caustic tank will be replaced in FY19. In addition, grating and chemical tank structure supports will be replaced in FY19.

Sunol Valley Water Treatment Plant

PAC and ozonation are planned treatment improvements for the SVWTP that will also mitigate future DBP episodes. PAC will be installed by the end of 2018, and ozonation is scheduled in the next 3 to 4 years. The SFPUC is installing a PAC addition facility at the SVWTP to mitigate the risk of T&O events. PAC adsorbs a variety of naturally occurring compounds in water. A type of PAC will be selected to primarily adsorb those compounds in the raw water that produce T&O problems; however, PAC will also provide some level of reduction in the compounds (also known as precursors) that generate DBPs. PAC will be fed to the raw water in a slurry form and subsequently removed in the SVWTP's sedimentation and filtration processes. The PAC system construction is starting in May 2018 and is tentatively scheduled to be running at the end of October 2018.

The scope of the SVWTP ozone project includes installation of ozone generators, ozone contactors, and other related upgrades to minimize T&O from the treated water coming out of SVWTP. This project addresses long-term T&O control associated with algal blooms in San Antonio and Calaveras Reservoirs.

Significant capital work was completed at the SVWTP in 2013 and 2015 through the SVWTP Long-Term Project (WSIP) and the upgrades made due to the LCA emergency. However, a long list of additional R&R work continues to be necessary for plant operational reliability, especially when production rates are high. Capital work primarily completed in 2013 and 2015 addressed seismic LOS and the addition of the 17-million-gallon treated water reservoir. Those capital projects did not address plant reliability. Therefore to make the plant reliable at high production rates, the following scope of work is needed, including, adding polymer feeds at Basin 5 (WSIP) and at Basins 1 through 4; washwater tank valve electric actuator and washwater tank seismic upgrades; repair of sedimentation basin concrete spalling; HVAC controls in the new server room; and reliability of the 2-megawatt generator.

Harry Tracy Water Treatment Plant

Several critical systems supplied by the WSIP were commissioned. The sludge-handling system, which includes centrifuges and emergency power generators, had lingering issues that are still being tested and corrected. Project documentation and the creation of standard operating procedures are under development. Additional Job Order Contracts underway in FY18 that will continue into FY19 include:

- CAT-ISO training and programming modifications;
- automating a 12-inch butterfly valve at the filter-to-waste manhole;
- Sludge Tank No. 1 piping modifications and electrical modifications;
- emergency generator filters upgrade;
- new structure leak repairs;
- variable frequency drives for sludge transfer pumps;
- diesel fuel double containment piping;
- fire-suppression system at the raw water pump station;

- vibration control on panel and circuit breakers at the raw water pump station; and
- equalization basin mixers.

Groundwater Storage and Recovery Project

Over the next year, the SFPUC will develop staffing and maintenance plans for the new groundwater wells associated with the GSR project.

4.3.2 Nitrification Management Program

During FY17 and FY18, the SFPUC continued to implement a proactive nitrification prevention and response strategy that required minimal operational response and prevented disinfectant loss in the distribution system. The nitrification mitigation strategies that were employed are summarized in the following paragraphs.

Regional Water System

For the RWS, mitigation strategies included:

- maintaining a chloramine residual target of 2.8 milligrams per liter entering the transmission system year-round;
- maintaining an overall chlorine:ammonia weight ratio of 4.7:1 for water entering the RWS to form chloramines with minimal free ammonia; and
- maintaining a high pH target in the RWS year-round.

San Francisco Retail Water System (in San Francisco)

For the San Francisco Retail Water System, mitigation strategies included:

- conducting vigilant monitoring for total chlorine, free ammonia, and nitrite in key pressure zones in San Francisco, and continuously evaluating water quality trends throughout the year;
- providing continuous chlorine trim at seven locations in San Francisco to combine with free ammonia in the distribution system, and maintaining the chloramine residual above target;
- operating mechanical mixers in eight reservoirs and four tanks to prevent stratification and short-circuiting of flow;
- cleaning and disinfecting reservoirs and tanks as needed to remove sediments and biofilm;
- conducting localized flushing in areas of low chlorine residual and manual chlorine boosting at tanks;
- restarting post-drought system flushing programs in 2016 and a dead-end flushing program in late 2017;
- reducing storage at various tanks and reservoirs to increase turnover and reduce water age in the distribution system; and

- deep-cycling reservoirs to turn over reservoirs with fresh water.

The actions taken in San Francisco are potentially useful for wholesale customers who are managing their own nitrification prevention and response activities. The WQD can be consulted for additional details.

4.4 Buildings and Grounds

The WSTD Buildings and Grounds section serves the maintenance, repair, and operational needs of the facilities, structures, and grounds in San Mateo, Santa Clara, and Alameda Counties, with a few facilities in western San Joaquin County. The Buildings and Grounds section strives to preserve and improve departmental assets through both preventive (planned) maintenance and emergency repairs when required, to provide for the comfort of building occupants, and to identify capital improvement needs for these facilities. Assets under the responsibility of this maintenance program include administration buildings, corporation yards, residential cottages, and public recreation facilities such as the Pulgas Temple and the Sunol Temple. There are about 20 watershed structures that are either occupied as residences for staff or used for monitoring or office work in the Bay Area; and many more watershed structures are upcountry.

Aside from construction and maintenance, staff also document permits for compliance associated with general corporation yard activities. Work includes:

- operating and maintaining fuel stations and underground fuel storage tanks to ensure compliance with Bay Area Air Quality Management District and SWRCB requirements;
- coordinating with local jurisdictions and the San Francisco Department of Public Health to manage hazardous waste storage and disposal in the corporation yards;
- preparing and submitting reports, documentation, and permits for generators, pressure vessels, and waste hauling;
- testing and certifying cranes throughout the division to ensure compliance with California safety regulations; and
- documenting shoring excavations to provide safe working conditions for craft workers.

4.4.1 HHWP

The HHWP shops and buildings are original and vary in age from 45 to 80 years old. In 2009, a condition assessment of the Moccasin Facilities identified deficiencies in many of the buildings. Of greatest concern was the building housing the plumbing shop, field office, and tool room. This building had multiple deficiencies, including unsafe electrical conditions, unsafe conditions for storing fuel, insufficient workspace area, and inaccessible restrooms.

Recently completed in April 2018 is the new maintenance and tech shop, 10,000 square feet of combination shops and office building, consisting of a plumbing shop, vegetation management shop, ROW shop, electronic technician shop, lockers, shower facilities, and a break room. HHWP will propose additional facility upgrades identified in the 2009 condition assessment in future capital plans. Improvements include a warehouse addition, storage, truck port, automobile/machine shop addition, carpentry shop addition, material bins, and security gate.

The Moccasin Wastewater Treatment Plant serves the town of Moccasin. The town of Moccasin houses employees of the SFPUC. About 100 people live in Moccasin, and approximately 200 people work in Moccasin on weekdays. An evaluation of the treatment plant was performed in September 2011. The report highlights many of the operational limitations and challenges currently observed by HHWP staff, including:

- solids, rocks, grit, rags, and debris that adversely affect the current design;
- poor screening facilities;
- unavailability of grit removal facilities;
- lack of control of air in aeration basin;
- a settling tank subject to mechanical failure;
- difficulty controlling sludge return rates;
- poor flow distribution from the aeration tank to the clarifier; and
- insufficient capacities in the lower camp lift station pump.

HHWP will propose a replacement facility in future capital plans.

4.4.2 WSTD

Highlights of accomplishments and efforts for this program in FY17 and FY18 include:

- relocation of plumbers to the North Shops building, and buildout of materials racks and second-level storage areas inside the shop area;

- development of the second phase of the roofing project, to include Davis Tunnel Cottage, San Andreas Tunnel Cottage, Cypress Work Center, and Upper Crystal Springs Cottage;

- continued implementation of the water conservation plan and removal of nonessential landscape, review of irrigation infrastructure and practices, and replacement of inefficient fixtures;

- coordination with San Francisco Department of Public Works to remove an obsolete underground waste oil tank in the Millbrae Yard;

- relocation of EMT (Emergency Medical Technician) trailers to HTWTP, including improvements to trailers with painting and new flooring;

- upgrades to the Millbrae Small Conference Room;

- mold remediation of the Sunol Plant break room, with new sink and cabinets;

- replacement of an old chiller used for HVAC at the Millbrae Water Quality Laboratory;

- remodeling of the Engineering section’s library and map room;

- assessment of the Calaveras Dam Cottage;

- development of a Hazardous Materials and Spill control plan for the new Sunol Yard; and
- purchase of the Rollins Facility in September 2017.

Planned work for FY19 and FY20 includes:

- continuing to revise and update cottage needs assessments plans;
- continuing to apply the water conservation plan, identify and remove nonessential landscapes, and expand the use of hardscape and drought-resistant plantings;
- implementing plans to repair, remodel, and provide upgrades to San Andreas Cottage and Calaveras Dam Cottage, and restore both to service;
- implementing the second phase of the roofing project to include Davis Tunnel Cottage, San Andreas Tunnel Cottage, Cypress Work Center, and Upper Crystal Springs Cottage;
- completing the project to remove underground the waste oil tank in the Millbrae Yard;
- completing the removal of aboveground fuel tanks at the Sunol Golf Course;
- Performing reviews and updates of the Hazardous Materials Business and Spill Control plans for yards, miscellaneous small facilities, and valve lots; and
- providing construction support at the Sunol Yard.

4.5 Watersheds and Right-of-Way Lands

There are approximately 60,000 acres of watershed land and 210 miles of pipeline ROW in the Bay Area in Alameda, Santa Clara, and San Mateo Counties. Moreover, there are 420,000 additional acres of watershed land and 150 miles of pipeline ROW upcountry in the Sierra Nevada mountains. The SFPUC manages these lands and the natural resources that depend on them, in accordance with the Water Enterprise Environmental Stewardship Policy, the Alameda and Peninsula Watershed Management Plans, and ROW vegetation and encroachment policies, all adopted by the Commission. These "natural" assets include the O&M of roads, bridges, culverts, fences, gates, and signage. Vegetation management is also an important component and is done to minimize fire risk, avoid and minimize threats from invasive species, protect structural assets, enhance water quality, and protect and/or restore native species and their habitats. Protection and restoration of native species helps support compliance with federal and state environmental regulations for the RWS, and hence minimizes regulatory risks and uncertainties; this provides for greater water supply reliability for customers.

The Watershed and Environmental Improvement Program (WEIP) is partially supported by WSIP funding, and was initiated to further protect important watershed and ROW lands. Investments include working with willing landowners in watersheds above Bay Area reservoirs to protect and restore water quality and habitat for native species, and also providing education opportunities (e.g., additional recreation) consistent with watershed management plans and ROW policies.

The investment in maintenance, preservation, and restoration of the ecosystem services provided by this "natural" capital is increasingly recognized in traditional water utility asset management, and the SFPUC will continue to work closely with other Bay Area and Pacific Northwest utilities to describe and capture these benefits and their associated O&M costs.

4.5.1 Tuolumne Watershed and ROW

Condition assessments were performed on HHWP bridges between 2013 and 2014. The condition assessment included visual inspections and review of load ratings for all bridges. Hydraulic/scour and seismic capacity assessments were performed for a subset of bridges, based mainly on public access. HHWP has not received any notifications from federal or state agencies mandating improvements to bridges. However, HHWP will address safety/design deficiecies.

The following defencies must be addressed. The Moccasin Debris Deflector Bridge and the Maintenance Bridges over the California Aqueduct occasionally serve as work platforms for maintenance crews, but lack safety railings that conform to current Occupational Safety and Health Administration (OSHA) standards. Replacement of the substandard railings at O'Shaughnessy Adit Access Bridge and improvement of the guardrail system and signage for Holm Access Bridge are also considered high priority for reasons of safety. Replacement of the Turkey Ranch Bridge and Oakdale Irrigation District Bridge 1 are also a high priority, because these bridges are significantly deteriorated and provide critical access to HHWP facilities. Some specific improvements at Oakdale Irrigation District Bridge 2 are high priority, such as placement of approach markers. These high-priority projects will be completed by 2025.

Replacement of the Cherry Lake Road Bridge at Early Intake is a medium priority, due to the various structural and safety deficiencies, the limited remaining service life expected for this bridge, and its importance to HHWP's operational access. The recommended approach rail and safety improvements for the Cherry Lake Road Bridge over the Middle Fork Tuolumne River and the South Fork Siphon Adit Access Bridge are a medium priority. The replacement projects recommended for the O'Shaughnessy Adit Access and Cherry Creek bridges are a lower priority. This is mainly because the deficiencies identified in these bridges are primarily associated with their capacity for resisting seismic (lateral) loads, which represent a relatively severe but unusual load case. These bridges are in the 2018, 10-year capital program.

A condition assessment was performed on Cherry Lake Road and Hetch Hetchy Road in 2013. Many projects were identified and are in the capital plan, as discussed in the following paragraphs.

- **Guardrails:** Install new guardrails where the potential hazard is the greatest, such as locations with steep drop-offs and sharp curves, and at existing bridge approaches with substandard rails. Replace existing railroad-rail guardrails with standard metal-beam guardrails.

- **Pavement rehabilitation:** Perform structural pavement section rehabilitation or full section replacement annually at areas of severe potholes; alligator cracking; and pavement distortions, rutting, and depressions.

Locations have been prioritized and projects will be undertaken by location over the 10-year period. Funding available for improvements previously described will vary by year, depending on projects to address unplanned damage that occurs throughout the winter. For example, during the floods of 2017, damage occurred at 20 locations along Cherry Lake Road and Hetch Hetchy Road. Projects to correct this damage were undertaken in the summer/fall of 2017 and will be completed in summer 2018. These projects delayed planned projects on these assets by 2 years.

4.5.2 Bay Area Watersheds and ROW

In previous FYs, WSIP funds supported the protection of three properties in the Alameda Watershed in perpetuity. Two of these are now owned in fee by the SFPUC, and are being incorporated into the existing rangeland management program. The third is now owned by Santa Clara County Parks. The NRLMD staff continues to seek additional projects like these, in partnership with the California Rangeland Trust, The Nature Conservancy, Alameda County Resource Conservation District, and Santa Clara County.

The focus for the previous two FYs has been on Peninsula Watershed education and recreation opportunities, specifically closing gaps in regional trails on and around SFPUC property. This work includes the Crystal Springs Regional Trail (operated and maintained by San Mateo County Parks), the Bay Area Ridge Trail (operated and maintained by NRLMD), and the proposed San Andreas Connector, which would link the Crystal Springs Regional Trail to the Bay Area Ridge Trail. All of these proposed projects are described in the Peninsula Watershed Management Plan.

The ROW team assembled to assist WSIP projects with clearing encroachments and confirming/acquiring easements or fee title began to shift their attention to other areas (non-WSIP) of the ROW to ensure access for O&M activity.

For the coming years, the two regional trails through the Peninsula Watershed—the Crystal Springs Regional Trail and the Bay Area Ridge Trail—have significant gaps that limit education and recreation opportunities. The SFPUC is assisting San Mateo County Parks in closing the gaps in the Crystal Springs Regional Trail, and is taking the lead to close one of the largest gaps in the Bay Area Ridge Trail. The SFPUC expects to complete environmental review of the Southern Skyline Boulevard Ridge Trail Extension Project in FY19, and complete construction of the new trail south from Highway 92 and connect to Golden Gate National Recreation Area and Mid-Peninsula Open Space District lands. The SFPUC was selected to receive a $1.0-million construction grant to support this project.

The Southern Skyline Boulevard Ridge Trail Extension project includes construction of approximately 6 miles of new trail from Highway 92 south the to the Golden Gate National Recreation Area's Phleger Estate; acquiring a trail easement from Skylawn currently held by the Bay Area Ridge Trail Council for the approximately 1.5 miles of existing trail north of Highway 92 to the SFPUC Cemetery Gate; and O&M of the entire Bay Area Ridge Trail on the Peninsula Watershed (approximately 16 miles total).

The WEIP efforts to protect watershed lands and natural resources, particularly in the Alameda Creek watershed, will continue. The ROW team also continues to diligently clear encroachments and acquire property rights necessary to ensure O&M of the RWS pipelines.

Other entities operate and maintain utilities in the watersheds and ROW lands. PG&E is currently planning major natural gas line testing and replacement in the Peninsula and Alameda Watersheds, and this will require a large amount of SFPUC staff time to facilitate the necessary real estate transactions (e.g., new permanent and/or temporary construction easements) and coordinate the construction and environmental compliance activity. In the Alameda Watershed, one of the natural gas line relocation projects will remove a fish migration barrier in Sunol Valley. The SFPUC is working closely with PG&E on the design of the project, which is expected to be constructed in FY20. In addition to natural gas line work, PG&E is expected to increase their vegetation management activity related to power lines maintenance and operation in response to new CPUC requirements issued in December 2017.

4.6 Communications Systems

Activities in this project include maintenance and upgrades of radio and SCADA communication systems. System components are usually implemented at more than one location and are intended to be consistent across the RWS and with other regional communication systems.

4.6.1 Radio/Communication System Upgrades

In 2012, the SFPUC initiated a thorough review of the radio communication needs for the operating divisions, which span seven counties and multiple jurisdictions. The review led to the microwave backbone project, which is a multi-phased project that resulted in connecting the entire RWS with a redundant system, and provides seamless communications among all SFPUC divisions throughout the service area. The first phase of the project will link the expanded microwave backbone installed upcountry to CCSF's backbone. Once a linked microwave system is created that follows CCSF's ROW and easements, the SFPUC can create a networked voice radio system that will significantly enhance day-to-day and emergency operations. Once complete, the entire SFPUC will be on one radio system. The communications system will cover over 90% of the SFPUC Water Enterprise service and operational area and will be specifically enhanced to cover inside the O'Shaughnessy Dam.

In FY16 and FY17, expansion work on the upcountry and San Joaquin Valley microwave systems and connection to the Bay Area system was completed. The San Joaquin Valley Communication System Upgrade project connects facilities and allows indication, security, and monitoring of the SJPL from the Moccasin Control Room. Completion of the microwave project has enabled HHWP to retire the remaining Remote Terminal Units on the project.

In FY17 and FY18, reliability enhancements to the Bay Area Microwave backbone used by the SCADA, Business, and Voice Radio networks were performed. Redundant microwave paths were completed to provide better performance. The Bay Area Microwave backbone was expanded to provide connectivity to the upcountry and City systems. Upgrades were also made to existing microwave site nodes to increase reliability, capacity, and security. Redundancy was implemented on all links that did not already have it.

A request for proposal was published in October 2016 to replace the three low-band two-way radio systems with one robust, unified, commercial grade, communications system that is able to cover both concentrated urban environments and remote, rugged, rural areas, particularly for first responders following an earthquake, fire, or other disaster. In December 2017, a contract was signed with Motorola Radio Solutions to replace the legacy radio systems with one unified radio system that will be an extension of CCSF's new radio system. This system is anticipated to be complete in January 2020. Therefore, in FY17 and FY18, the ground work to create a unified SFPUC Voice and Data Radio system was completed with award, negotiations, and signature of a contract in December 2017. After a project review and initial site reviews, design began in March 2018. Project support personnel for this project were reassigned as shared resources from the RWS, and one permanent position at WSTD was reallocated for this project. When schedules allow, the CCSF's Department of Technology Radio Shop also provides one technician 1 day a week to assist with legacy radio installation and any radio maintenance needs. The existing legacy radio system requires frequent repairs due to age-related maintenance. The plan is to retire the legacy system after successful deployment of the new radio system. Furthermore, until the new radio system is in place, portable UHF radios will continue to be used and maintained for water treatment facility and pipeline inspection and maintenance work. The new radio system is designed to consolidate these different communications systems into one.

In FY19 and FY20, the SFPUC plan to explore geographically redundant microwave paths, with the continued goal of increasing the reliability and capacity of the Bay Area Microwave backbone.

Following the integration of many WSIP projects and facilities in the previous years, significant effort in FY17 and FY18 was expended on refining and optimizing process monitoring and control. As part of the GSR project, the integration of nine new remote well sites was initiated and will be completed in FY19. These nine wells connect directly to the RWS (see Section 2.2.1). Maintenance was performed on the SCADA Multiple Address System radio system consisting of radio frequency tuning and firmware upgrades. The virtualization of the SCADA and Enterprise Historian platforms continued, as did their housing in secure and environmentally controlled data centers.

In FY19 and FY20, the SFPUC plan to complete the SCADA integration of several projects, including: Calaveras Reservoir, Alameda Creek Fish Passage, and SVWTP PAC. Major version upgrades to the SCADA system software (Wonderware) and Enterprise Historian (eDNA) are planned, including the complete integration of the TTF standalone SCADA system into the Regional Water SCADA system. Reliability, performance, and security enhancements to the SCADA system server and network infrastructure will be ongoing. Migration of remote site backup communications from serial to Ethernet satellite service will be initiated.

4.6.2 Security Program

In 2006, a Vulnerability Assessment was performed for the SFPUC by a consultant (LLNL/ Guernsey). The assessment was performed partially in response to 9/11, but also to meet proposed AWWA guidelines for security standards. Since that time, the Department of Homeland Security initiated the NIPP, and the U.S. EPA has led development of the 2010 Water

Sector-Specific Plan 2010. This plan is updated in the 2015 Water and Wastewater Sector-Specific Plan. The Water Sector-Specific Plan largely models the AWWA guidelines and may ultimately become a regulatory basis for water utilities. The goal of the Security Program is to bring RWS facilities into compliance with the NIPP and U.S. EPA guidelines, as well as to protect employees and customers of the SFPUC.

The typical scope of a security project includes an alarm control and monitoring system (ACAMS) and a video management system (VMS) at each site. The ACAMS system will report and communicate directly with a regional server. The VMS at each location will have a local video recorder for forensic video retrieval. Minimally, a site will be equipped with intrusion detection and access control around the perimeter. Access control will be provided by electrified door hardware and a card reader, and will include door-position monitoring devices. Selected sites will include video cameras (fixed and operable) to record incidents and to enable operators to monitor the site remotely.

Security upgrades for the Bay Area were included in the WSIP. However, not all facilities deemed critical (Tier 1) were part of the WSIP, and security funding for those modified under the WSIP was not adequate in all cases. For these reasons, the water CIP is used to complete the program.

Part of WSIP funding was used to establish the overall platform for security. The platform includes the software used to accept, process, store, and display data from various sites. The Bay Area is divided into eastern and western autonomous zones (independent servers). In addition to the software platform and the onsite hardware installation, a significant integration effort is required to link the two and effectively bring the system into service on site one at a time.

In FY17, WSTD efforts continued to bring the security systems for additional Tier 1 facilities (see the list of Tier 1 facilities in Table C-1) into service and set up the necessary professional service contracts (design and installation) to implement the rest of the security program. As part of the WSIP, a design and installation of security equipment at selected facilities was completed in FY16. A new as-needed contract for design and installation was awarded in early 2018. As of July 17, 2018, no work has been done under this contract.

The SFPUC Emergency Planning and Security group is responsible for setting security policy and oversight of the Water Enterprise security system. In FY17, a new position, Security and Asset Protection Manager, was created and filled. The new Manager is leading initiatives to update vulnerability assessments, develop new security-related goals, and implement security program strategies throughout the RWS.

4.7 Construction Closeout Deliverables

Along with performance and acceptance testing, a major responsibility of the SFPUC during WSIP construction is to ensure that appropriate asset management deliverables are provided by project teams and contactors prior to project closeout. These deliverables include complete sets of equipment manuals (also called O&M Manuals), warranty information, record and as-built drawings, equipment inventory sheets, and, in some cases, specialized training, operating permits/agreements, and service agreements.

These deliverables are audited each quarter and reported to WSIP management, with formal reports beginning in FY12. With this diligent and sometimes labor-intensive tracking program, the percentage of closeout deliverables rose from 18 to 83 percent between 2012 and 2018. Staff remains focused on acquiring the outstanding deliverables, and progress will continue until all WSIP projects close. See Appendix G for the status of received deliverables.

4.8 Federal and State Regulatory Compliance

The SFPUC is required to comply with federal and state regulations to meet drinking water standards, safety, and environmental compliance regulations for O&M of the water system, including the watershed and ROW lands. A variety of regulatory measures associated with O&M activities is tracked and reported to ensure compliance, including the drinking water system permit administered by the SWRCB DDW (Section 4.8.2). Environmental regulatory compliance is described in more detail in Section 4.8.3.

The RWS must maintain various permits, plans, and procedures for their operations, including wastewater permits, discharge permits, Stormwater Pollution Prevention Plans, Hazardous Materials Business Plans, and Risk Management Plans. The SFPUC currently complies with regulations regarding hazardous material safety with respect to hazardous material disposal and employee safety.

4.8.1 Compliance with Emerging Federal and State Drinking Regulations

In addition to complying with the existing regulatory requirements, the SFPUC has also been keeping track of, and actively involved in, the regulatory development of drinking water regulations at the federal and state levels. Among the upcoming regulations, the long-term revisions of the LCR as well as the perchlorate MCL review may have impacts on RWS operations. Although neither of these regulatory changes has yet been proposed by the regulatory agencies, any changes to the optimized corrosion control requirements in federal and state LCRs, adoption of a federal perchlorate MCL, and/or changes to a lower state perchlorate MCL may affect and incur changes to the existing RWS treatment.

4.8.2 Drinking Water Permit Compliance

SWRCB DDW is responsible for implementing and enforcing drinking water regulations in California. In FY15, there was an incident of raw water from San Antonio Reservoir entering the transmission system on March 3, 2015. That incident led to a citation issued by the SWRCB to the SFPUC on May 8, 2016. SWRCB cited the RWS's failure to comply with the applicable water treatment standards under CCR and the drinking water permit issued in 2004. The citation specified ten directives that required SFPUC response. In a letter dated August 30, 2017, the SWRCB confirmed that the SFPUC has completely complied with Citation No. 02_04_15C_005, issued on May 8, 2015, for the March 3, 2015, incident. As of the time of this report preparation, the SFPUC is working on the project identified in its response to Directive No. 6 of the Citation, requiring installation of additional online water quality monitoring for Stanford Tunnel and near Ravenswood Valve Lot. Due to the discharge constraints at these sites, the SFPUC coordinated extensively with the SWRCB and obtained their approval to use zero-discharge online analyzers that allow sampled water to return to pipeline for delivery.

There were no other reportable citations or noncompliances incurred by the RWS in either FY17 or FY18.

4.8.3 Environmental Compliance

The Water Enterprise Environmental Stewardship Policy provides direction for the management of the lands and natural resources affected by operations of the SFPUC, and this policy includes complying with federal and state environmental regulations. Environmental compliance is also an objective under the Environmental Stewardship goal under the Water System LOS, and reduces risk associated with uncertainty to water supply reliability. Note that the Environmental Stewardship Policy is the responsibility of all Water Enterprise employees, and training is a critical aspect of providing staff with the information necessary to meet this goal.

The SFPUC's environmental compliance starts with impact avoidance and proactive environmental stewardship. SFPUC activities are reviewed and modified as needed to incorporate BMPs and environmental impact avoidance measures whenever feasible. When impacts cannot be avoided, permits are obtained to comply with environmental laws and regulations such as the California Fish and Game Code, the Clean Water Act, and the California and federal Endangered Species Acts. San Francisco's Planning Department prepares any necessary California Environmental Quality Act (CEQA) documentation, and the SFPUC oversees the compliance with the requirements of these documents. If a project triggers compliance with federal regulations, NRLMD works with the federal lead agency to prepare any required National Environmental Policy Act documents. Applications for third-party use of SFPUC-owned watershed and ROW lands are also evaluated for environmental compliance and consistency with SFPUC plans and policies through the Project Review process. The SFPUC regularly evaluates environmental compliance procedures and protocols in an effort to streamline the processes and ensure they are consistent across the system. Environmental compliance for O&M activities is documented through MAXIMO, in coordination with HHWP and WSTD maintenance planning teams, and the Project Review process, while larger projects maintain separate project-specific records of environmental compliance.

The SFPUC's environmental regulatory compliance includes the fulfillment of the mitigation commitments from the WSIP. These WSIP commitments include monitoring and maintenance of the Bioregional Habitat Restoration (BHR) projects, permit-required releases and bypass flows to benefit aquatic species below SFPUC dams and diversion structures, and amphibian and fish monitoring in Alameda and San Mateo Creeks. The BHR includes approximately 2,000 acres of lands set aside in perpetuity on the Alameda and Peninsula watersheds that must be maintained and monitored to meet specific environmental performance measures, as well as conservation bank credit purchases in the San Joaquin Valley. Support for the BHR effort has been funded by WSIP bond funds, and in recent years increasingly supplemented by CIP programmatic funds. This will continue, and CIP funds will be used to cover costs until an endowment can be established and the BHR effort can become self-sustaining.

SFPUC environmental permitting and compliance efforts include the ongoing development of a Habitat Conservation Plan for the Alameda Creek Watershed; Routine Maintenance Agreements and Lake and Streambed Alteration Agreements with the California Department of

Fish and Wildlife; permits for compliance with Sections 401, 402, and 404 of the Clean Water Act; California Air Resources Board permits; compliance with hazardous materials regulations; and federal special use permits with the National Park Service, the United States Forest Service, and the Bureau of Land Management**.**

4.8.4 National Pollutant Discharge Elimination System Permit Compliance

In 2016, the National Pollutant Discharge Elimination System (NPDES) Statewide Drinking Water Discharges Permit (NPDES Permit Number CAG140001) went into effect, and the SFPUC received coverage on January 20, 2016. This Permit replaced the individual permit for the Pulgas Dechloramination Facility, and the General NPDES Permit for Surface Water Treatment Facilities. Coverage under this Statewide Permit is comprehensive, because it includes chlorinated drinking water as well as groundwater, and spans the entire RWS from Hetch Hetchy to the CCSF's county line. Also in 2016, filter backwash discharges at HTWTP were covered under a new NPDES permit (NPDES Permit Number CAG382001). The SFPUC continues to receive coverage for discharges of aquatic pesticides (i.e., algaecides) into our drinking water reservoirs under the General Aquatic Pesticide Application Permit (NPDES Permit CA990005). The SFPUC NPDES permit coverage is provided by these three NPDES permits, and the SFPUC continues to work with the state and regional Boards to meet permit requirements and minimize impacts to receiving waters.

4.8.5 Dam Safety Compliance

In the wake of the February 2017 Oroville Dam Spillway incident, there were several changes in the state regulations for dam safety. The DSOD updated the hazard classification for all dams under state jurisdiction with respect to dam safety. This classification is based solely on downstream hazard considerations in the unlikely event that a dam failure results in an uncontrolled release of water, not the actual condition of the dam or its critical appurtenant structures. As can be seen in Table 3-2, 14 of the SFPUC's jurisdictional dams are assigned either the "extremely high" or "high" hazard categories, based on downstream hazard considerations (i.e., land use and population downstream).

The Governor ordered the DSOD to identify spillways in the state associated with large "extreme high" hazard dams that could pose significant risk to the public if a spillway incident similar to Oroville were to occur. Accordingly, the SFPUC received letters from the DSOD to order condition assessments of the spillways for O'Shaughnessy Dam, Cherry Valley Dam, James H. Turner Dam (San Antonio Reservoir), and San Andreas Dam. These condition assessments are all underway, and results will be available within calendar year 2018.

Newly enacted state law that became effective July 1, 2017, requires dam owners to prepare an EAP for their dams and critical appurtenant structures under certain conditions and in specific time limits (Water Code Sections 6160 and 6161). For dams meeting the "extremely high" and "high" hazard classifications, the EAP must be completed and submitted for the subject dam by January 1, 2018, and January 1, 2019, respectively. Prior to these dates, as required under the new law, an inundation map must be submitted for review and approval by the DSOD.

Additional state legislation requires the DSOD to update their inspection and reevaluation protocols by January 1, 2019. We anticipate that the updates to the DSOD protocols may trigger additional actions that will require the SFPUC to perform updated stability analyses and/or potential failure mode analyses as a direct result of the updated protocols.

Nevertheless, the SFPUC has proactively addressed known safety concerns with its dams and reservoirs in recent years, through large capital projects implemented through the WSIP or 10-year CIP. Projects implemented under the WSIP include the CDRP, LCSD Improvement Project, and seismic upgrades and other improvements to two RWS reservoirs in San Francisco, including Sunset North Basin and University Mound North Basin. Recent and/or ongoing condition assessments and planning studies for dams, spillways, outlet works/valves, and/or other appurtenant facilities being implemented under the 10-year CIP include Pilarcitos Dam, San Andreas Dam, Cherry Valley Dam, Early Intake Dam, Lake Eleanor Dam, and O'Shaughnessy Dam. In addition, the Moccasin Lower Dam and spillways (including the main and auxiliary spillways) are currently being evaluated in the aftermath of the March 22, 2018, extreme storm event.

These recent changes in regulations generated numerous dam and appurtenance assessments, which we anticipate will result in additional capital projects to address dam safety issues revealed through the ongoing condition assessments and reevaluation of existing facilities in the coming years.

5. Capital Improvement Program

Capital projects that support the RWS are organized into a 10-year CIP that is adopted each year and integrated into the SFPUC's Financial Plan and rate-setting calculations. Major updates to the CIP generally happen every 2 years, in coordination with the overall budget process (see Section 3.5). For budgetary purposes, the RWS CIP is contained in two planning documents: the Water CIP (Section 5.2.1) and the HHWP CIP (Section 5.2.2). The Water CIP includes capital projects related to the RWS west of AEP, TTF, and the retail-funded local distribution system. The HHWP CIP includes projects east of AEP funded by water revenues (retail and wholesale), power revenues, and projects funded jointly from each enterprise. For purposes of presentation here, the retail water capital projects and retail power capital projects are not shown.

5.1 Capital Planning Process

5.1.1 Identifying Potential Capital Projects

In the post-WSIP era, much of the focus on the RWS CIP is on maintaining LOS (Section 3.1.1) and completion of deferred projects that were not included in the WSIP. However, capital project scope can be identified through one or more mechanisms. Typically, most capital projects are generated through periodic inspection of facilities or through capital planning work that incorporates operator records, performance data, customer input/complaints, and/or pending regulatory/legislative changes. Additionally, other capital projects emerge from joint capital planning efforts with other agencies, such as many of the recycled water projects. A significant amount of capital scope is still developed through more reactive means, such as emergency response or unplanned failures of assets.

5.1.2 Cost Estimation and Projecting Cash Flow

For preparation of the CIP, costs are largely estimated by analogy to similar and recent projects completed by the SFPUC. Staff experience and recent bids are used to refine the estimate. Appropriate escalation is applied when using prior projects for a cost basis. Additionally costs are escalated throughout future years in the CIP at 3 percent per year.

Cost estimates include construction contingencies, allowances, soft costs (project management, administration, design, construction management, environmental review, legal, etc.), land acquisition, site remediation, and closeout. Soft costs are usually prorated based on construction costs, historically around 30 to 35 percent. For major capital projects, an engineer's estimate is performed at the 35 percent design completion milestone, and an independent estimate is performed at the 95 percent design completion stage.

Cash-flow requirements are expressed in terms of annual appropriations required to fund the project without interruption, anticipating funding needs prior to when expenses are incurred. Cash flow is not otherwise front-loaded. Construction costs are usually put in the FY coinciding with Commission award of the construction contract, even though actual cash payments to the contractor may occur over several years.

For the purposes of the CIP, it is assumed that prior appropriated funds will be fully expended. Estimates of annual O&M costs include loaded labor and supplies/materials. Cost estimates for capital projects are within general ranges that decrease as project uncertainties decrease through the development of the project. Typical industry standard accuracy ranges are:

- preliminary planning estimates (+50 to -30 percent);
- completion-of-planning estimates (+30 to -15 percent); and
- design-level estimates (+15 to -5 percent).

These ranges do not represent project contingency, which is retained as a line item in the estimate. An accuracy range is not used for projects under construction, because the contract includes contingency (usually 10 percent) plus allowances.

For major capital projects, the Earned Value Method is used for cost control after the tasks are resource-loaded. Progress is tracked by measuring the schedule and cost variances together with the milestone and deliverable variances. A trend program is developed and implemented for large projects, along with a change management process involving key staff. The CIP project summaries used for budgeting and resource planning also partition the cash flow by project phase (planning, design, environmental, construction, etc.)

5.1.3 Prioritization Process

After capital projects are scoped at the planning level and a planning-level cost estimate is calculated, the prioritization process begins. Projects are designated as Priority 1, 2, or 3. Priority 3 projects are not included in the Financial Plan.

Priority 1

Priority 1 projects include projects that must be completed to maintain adopted LOS; ensure safety for employees or the public; avoid significant liabilities; or comply with laws, contracts, or SFPUC Commission policies. These projects are usually not discretionary at the staff level, and are the highest priority. Other examples of Priority 1 projects include supplemental funding needed to complete construction. Emergency declarations following failure of infrastructure may not be planned or budgeted. A supplemental appropriation can be used; otherwise, near-term appropriations are reprioritized.

Priority 1 projects do not necessarily require Year 1 or even near-term funding. Funding is programmed into appropriate years, as needed to ensure project delivery.

Priority 2

Priority 2 projects are reserved for those projects that are cost-effective or are otherwise considered to be consistent with BMPs. Examples include projects that extend the life of an asset, allow participation in an externally funded partnership (grants, etc.) or that have a rate of return on investment within 10 years.

Priority 3

Priority Level 3 projects usually are discretionary; are incompletely scoped; have unclear schedule or cost estimates; have external funding yet to be secured; or have pending agreements, etc. These projects are internally referred to as Candidate Projects and may remain so for more than one budget cycle.

Final Ranking

After this general priority setting process, not surprisingly, more quantifiable ranking is needed before projects can be evaluated for inclusion in the CIP—particularly for Priority 1 projects. The process can also help determine whether Priority 1 projects are better classified as Priority 2, or vice versa. A quantifiable prioritization is achieved by using an industry standard risk analysis—applying a risk score to each risk based on consequence and likelihood of failure associated with the risk (Figure 5-1) that would be addressed by a proposed capital project. Risk in this context is interpreted in terms of ability to address any Priority 1 factors, such as LOS or safety.

Figure 5-1: Risk Matrix for Prioritization

Likelihood of Failure		**Risk Matrix**				
Very High	5	11	16	20	23	25
High	4	7	12	17	21	24
Moderate	3	4	8	13	18	22
Low	2	2	5	9	14	19
Remote	1	1	3	6	10	15
Consequence of Failure		1	2	3	4	5
		Level 0	Level 1	Level 2	Level 3	Level 4

To further the above objective, during the FY19-28 CIP cycle, projects received a Criticality Ranking that incorporated factors about each asset, including:

- remaining useful life (years);
- whether the project was in progress;
- impact to operations (low to severe);
- whether the project was politically sensitive;
- whether other projects were dependent on the completion of the project in question;
- consequences of failure (low to severe); and
- whether the project satisfied a regulatory requirement.

The Criticality Ranking was used to inform choices about which projects to include in the final 10-year CIP.

5.1.4 CIP Project Management/Project Controls

A project is formally initiated when the planning process begins and a project manager is assigned. At this time, a preliminary "planning level" budget is used to establish the project's initial Approved Budget. Assignment of a project manager can vary. Typically, the manager resides in the SFPUC Infrastructure Division, the division with primary responsibility for capital project delivery. However, depending on the project scope, expertise, and availability of Water Enterprise staff, the project manager may reside in the Water Enterprise.

During the planning phase, many of the methods developed under the WSIP remain in use to help ensure that adequate scoping is performed, that appropriate review by managers and subject matter experts takes place, and that all alternatives are thoroughly vetted and evaluated. Four key planning documents are typically prepared and signed off on by key managers. These include the Needs Assessment Report, the Alternatives Analysis Report (AAR), the Conceptual Engineering Report, and the Design Criteria. The AAR usually concludes with a recommended alternative, which then proceeds to design and environmental review. Many projects will also retain the Steering Committee concept from the WSIP as the primary decision-making body for a project. This committee consists of division managers in Infrastructure and the affected operating division.

Budget control usually resides at the program level, where annual capital appropriations are placed. Use of the budget in the program can be dedicated by the appropriate division manager to a project with a scope that is consistent with the corresponding budget request for the program.

WSIP reporting methods and formats are also used for quarterly CIP reporting, as feasible. As of FY18/19, quarterly CIP reports to the SFPUC Commission will include all projects over $5 million, including specific projects over that amount that reside under a larger budget program.

SFPUC Commission action is required for all CEQA actions; the Commission adopts the Mitigation Monitoring and Reporting Programs for a project, or records in the agenda that a project is categorically exempt from CEQA. The Commission also approves the project and awards most contracts (professional services, construction, etc.). The Commission may also give direction on the project's scope, budget, schedule, or even its necessity during review and approval of the CIP and budget, or while considering the actions listed above. Final CEQA approval actions are taken by the Planning Commission.

While the project is active, modification to a project's budget can then be controlled by the division manager, as long as the budget in the broader capital program that houses the project is not exceeded. Change order authority of 10 percent for the construction contracts is typically granted by the Commission.

Each quarter, the SFPUC publishes a capital report that summarizes the status of each capital project. The status includes comparisons between adopted budgets and schedules and what the project manager is forecasting. At this time, the forecast budget (as discussed above) and schedule may replace prior versions as the new baseline for a project, after discussion with the Assistant General Manager of the Water Enterprise.

5.2 10-Year CIP

There are seven active programs in the RWS CIP, including a programmatic planning program used for feasibility planning for future capital projects.

- **Water Treatment Program:** This program focuses on existing and new treatment facilities that typically involve chemical systems and/or water-quality monitoring systems. The program includes upgrades of chemical dosage, flow monitoring, valve and pump replacement, chemical handling upgrades, power upgrades, systems to control discharges to maintain compliance with permits, communications, process control equipment to meet more stringent drinking water regulations, seismic improvements, and upgrades to control software. Improvements at SVWTP for managing T&O issues have been prioritized.

- **Water Transmission Program:** This program encompasses upgrades to the conveyance/ transmission system, including pipelines, tunnels, penstocks, valves, appurtenances, meters, CP, pump stations, and vaults. Upgrades to the Palo Alto Pipeline, the SAPL No. 2 through San Bruno, and the CSPL No. 2 through Hillsborough have been prioritized.

- **Water Supply and Storage Program**: This program encompasses projects involving storage facilities (including dams) and new supply such as desalination, recycled water, and groundwater. The program includes upgrades to structures to meet DSOD requirements, including geotechnical work and installation of monitoring systems, and modifications to spillways and outlet structures. Upgrades to Pilarcitos, San Andreas, and James H. Turner (San Antonio Reservoir) dams are included in the CIP. The Daly City Recycled Water Project is also a significant component of the CIP.

- **Watershed and ROW Lands Management Program:** This program supports projects that improve and/or protect the water quality and/or ecological resources affected by the operation of the SFPUC. Projects in this program include watershed infrastructure maintenance/repair (roads, culverts, fences, etc.) and land acquisition. This program in the CIP will support long-term monitoring of rehabilitated construction sites, as well as instream flow management below dams over the course of the CIP.

- **Communications and Monitoring System Program:** This program is reserved for upgrades to and R&R of regional communication and monitoring systems, such as SCADA, radio, security, and other data transmission equipment/infrastructure. Assets typically reside in numerous locations regionwide. The major project in the CIP involves continued construction of a microwave backbone that would provide an independent communication link between upcountry and the four Bay Area counties served by the SFPUC, as well as security improvements to SFPUC facilities.

- **Buildings and Grounds Program:** This program encompasses capital improvements to existing buildings, grounds, structures, and ROWs that are not directly related to day-to-day operations or watersheds. Examples include administration buildings, cooperation/storage yards, and miscellaneous properties. The major projects in the CIP include upgrades to the Millbrae Yard, completing upgrades being made to Sunol administration facilities and laboratories, and construction of a new watershed center in Sunol.

- **Programmatic Studies:** The programmatic section of the CIP includes water resources-related planning studies. Examples include feasibility studies for recycled water, conservation (including aspects of implementation), and desalination.

One or more projects can form a program, with projects being the basic units of the CIP. A project is typically a stand-alone capital improvement project above $5 million in construction cost, with a defined and approved scope, budget, and schedule managed by an assigned project manager. R&R projects are also included in the CIP. These projects are usually cash-funded and are not designed to extend the life of the overall asset (or facility).

Budgets are approved and controlled at the program levels outlined above. During budget preparation, forecast budgets are reviewed for each active or planned capital project; R&R

programs are also reviewed, and adjustments are made accordingly. When the budget is prepared for Commission and stakeholder review, staff also document that the capital plan is consistent with LOS.

Programs for the HHWP CIP are differentiated by funding source, as described in the following paragraphs.

- **Water Infrastructure:** The Water program includes water-only assets and water quality projects, and includes upgrades for increased capacity and reliability to the HHWP Water Infrastructure, including continued rehabilitation of the SJPLs, construction of a transmission line between Priest Reservoir and Moccasin, construction of a Moccasin Reservoir security fence, and Early Intake Dam rehabilitation.

- **Joint Infrastructure:** The Joint program includes projects that are used for both water and power assets. Projects in this category are used to support the infrastructure required for O&M for both the HHWP water and power systems, including improvements to facilities at Moccasin, facilities outside Moccasin, road improvements, facility security, and communication projects. This program in the 10-Year CIP will fund Mountain Tunnel rehabilitation, O'Shaughnessy Dam outlet works improvements, and Eleanor Dam rehabilitation.

- **Power Infrastructure:** The Power program includes power assets only. Projects in this category include R&R of HHWP transmission lines, and clearance mitigation and improvements to penstocks.

5.2.1 10-Year Water CIP Update, FY19 – FY28

The FY19-FY28 10-year Water CIP ("FY19 Water CIP") includes $893.0 million in projects for these programs (not including programmatic projects). Between 2000 and 2004, various condition assessment and vulnerability studies were completed, along with an intensive effort to define and adopt LOS to guide the capital program for the RWS. Much of the scope that would become the WSIP—largely documented in the FY02 CIP—was derived from these efforts. However, many capital projects identified in these early planning studies[20] were not ultimately included in the WSIP, because there was either no direct linkage to LOS, or the projects themselves from the onset were identified as deferrable to later years after more critical capital projects were completed. With the WSIP in the final phases of construction, those projects that address LOS are nearing completion; the focus of capital improvements is shifting to other critical needs, such as aging infrastructure and operational improvements. To leverage the work and institutional knowledge from prior condition assessments and vulnerability studies, the improvement needs identified in these studies are being consolidated and reviewed. In addition, these needs are organized into one of the six capital programs (excluding programmatic studies) of the CIP: Water Treatment, Water Transmission, Water Supply and Storage, Watershed and ROW Lands Management, Communications and Monitoring System, and Buildings and Grounds. The consolidation of these project lists was followed by a review of the Master Plan Schedule. The timing of the Master Plans will be coordinated with the CIP schedule, so that the results will be available to inform the planning and design of the CIP projects.

[20] 2002 Capital Improvement Program, 2004 Reliability Study Phase III, and 2004 Peninsula Improvement Program.

WSIP construction will continue through FY21; however, only $62 million of supplemental funding for WSIP projects is included in the current CIP, because all other WSIP appropriations were included in prior budget years.

Project-by-project details of the FY19 Water CIP are included in Appendix J. Each project addresses one or more of the following areas:

- renewal projects that either maintain or enhance LOS;
- larger capital upgrades required to maintain LOS and involving new or replacement facilities, with implementation mostly in the later years of the 10-year CIP;
- necessary capital upgrades to administrative and field support facilities;
- capital planning studies; and
- required monitoring to support capital projects.

No projects in the CIP are needed to directly respond to pending regulatory changes (SWRCB/ Drinking Water Program, NPDES, etc.).

5.2.2 10-Year Hetch Hetchy CIP Update, FY19-FY28

The FY19-FY28 10-year HHWP CIP ("FY19 HHWP CIP") includes $767.1 million in projects funded by water rates either as water-only or jointly with the SFPUC Power Enterprise. In addition to LOS, the HHWP CIP is designed to sustain the SFPUC's existing unfiltered water source and gravity-driven system. Project-by-project details of the HHWP CIP are included in Appendix J. The most significant project in the FY19 HHWP CIP is the Mountain Tunnel Rehabilitation Project.

5.3 Water System Improvement Program

Approximately $1.2 billion in WSIP projects are active during the summer of 2018; the significant program milestone of completion of the embankment dam of the CDRP is expected to be reached in 2018, with final project completion in 2019. Major ongoing construction activities include the CDRP, the Fish Passage Facilities at Upper Alameda Creek Diversion Dam (sub-project to the CDRP), and the GSR. As of summer 2018, all but three of the Regional WSIP projects are in service and are meeting their intended LOS goals and objectives. Final administrative closeout of NIT, BDPL Reliability Upgrade – Tunnel (Bay Tunnel), Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault, and HTWTP Long-Term Improvements have all been achieved. After the end of 2018, it is expected that only three Regional WSIP projects will remain active: the CDRP (the main project as well as the fish passage facilities sub-project), Alameda Creek Recapture, and Regional Groundwater Storage and Recovery. In addition, several support projects as well as two of the four regional WSIP Closeout projects created to address miscellaneous items needed to fully meet the intended LOS will continue to the end of the program in 2021.

Table 5-1 lists the current status of WSIP projects. For the purposes of this report and table, projects are considered to be "in service" and subject to asset management programs of the Water Enterprise when substantial completion is reached. This terminology is a departure from WSIP reporting where "closeout" or "completed" may be used. The distinction between these latter terms is not particularly relevant for the owner/operator, because a project may be in closeout for many months prior to completion, even though the facility is in service.

Table 5-1: Status of Water System Improvement Program Projects

Project	Status
SJPL System	In service
Rehabilitation of Existing SJPL	In service
TTF	In service
Lawrence Livermore Water Quality Improvement Facility	In service
Alameda Creek Recapture	Environmental Review
Calaveras Dam Replacement	Construction
SABPL	In service
NIT	In service
SVWTP Expansion and Treatment Water Reservoir	In service
Alameda Siphon No. 4	In service
SAPS Upgrade	In service
Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	In service
BDPL Reliability Upgrade – Tunnel	In service
BDPL Reliability Upgrade – Pipeline (East Bay)	In service
BDPL Reliability Upgrade – Pipeline (Peninsula)	In service
BDPL Reliability Upgrade – Relocation of BDPL Nos. 1 and 2	In service
SCADA System – II	In service
System Security Upgrades	In service
BDPL Nos. 3 and 4 Crossovers	In service
BDPL No. 4 Condition Assessment PCCP Sections	In service
SFPUC/EBMUD Intertie	In service
Pulgas Balancing – Structural Rehabilitation and Roof Replacement	In service
Pulgas Balancing – Modifications of the Existing Dechloramination Facility	In service
Crystal Springs/San Andreas Transmission System	In service
Baden and San Pedro Valve Lots Improvements	In service
HTWTP Long-Term Improvements	In service
New Crystal Springs Bypass Tunnel	In service
LCSD Improvements	In service
CSPL No. 2 Replacement	In service
SAPL No. 3 Installation	In service
PPSU	In service
Sunset Reservoir – North Basin	In service

Project	Status
University Mound – North Basin	In service
GSR Project	Project in Multiple Contracts; one in service, one in construction, and one in design
HTWTP Short-Term Improvements – Coagulation and Flocculation	In service
Pulgas Balancing – Discharge Channel Modifications	In service
Cross-Connection Controls	In service
HTWTP Short-Term Improvements – Demo Filters	In service
Adit Leak Repair – Crystal Springs/Calaveras	In service
Capuchino Valve Lot Improvements	In service
Pulgas Balancing – Inlet/Outlet Work	In service
Standby Power Facilities – Various Locations	In service
WEIP	Ongoing

Notes:
BDPL = Bay Division Pipeline
CSPL = Crystal Springs Pipeline
EBMUD = East Bay Municipal Utility District
GSR = Regional Groundwater Storage and Recovery Project
HTWTP = Harry Tracy Water Treatment Plant
LCSD = Lower Crystal Springs Dam
NIT = New Irvington Tunnel
PCCP = prestressed concrete cylinder pipe
PPSU = Peninsula Pipelines Seismic Upgrade
SABPL = San Antonio Backup Pipeline
SAPL = San Andreas Pipeline
SAPS = San Antonio Pump Station
SCADA = Supervisory Control and Data Acquisition
SFPUC = San Francisco Public Utilities Commission
SJPL = San Joaquin Pipeline
SVWTP = Sunol Valley Water Treatment Plant
TTF = Tesla Treatment Facility
WEIP = Watershed and Environmental Improvement Program

5.4 Seismic Improvements

During FY17 and FY18, significant seismic improvements have been made for many assets and facilities in the RWS through phased WSIP implementation, PM, and 10-Year CIP projects. Notably, with the completion of the PPSU – Phase 3 in 2017, which is the first major seismic project that is not within the WSIP, the seismic LOS goals and objectives set forth under the WSIP have now been achieved.

For additional information, specific seismic capital improvements from the last 10 years are listed in Table A-18 in Appendix A, displayed from east to west in the conveyance system. Collectively, these improvements help meet seismic response and water system performance LOS objectives. WSIP projects not listed in Table A-18 add additional seismic improvements, because all new construction uses higher seismic design specifications. No seismic upgrades at HHWP are listed in Table A-18. At HHWP, new and rehabilitation projects are designed to meet current seismic standards. HHWP does not have a count on the number of facilities that do not meet current seismic standards.

5.5 Dam Safety Improvements

The SFPUC has proactively addressed known safety concerns with its dams and reservoirs in recent years, through large capital projects implemented through the WSIP or the 10-year CIP. The projects implemented under the WSIP include the CDRP, LCSD Improvement Project, and seismic upgrades and other improvements to five reservoirs in San Francisco, including Stanford Heights, Summit, Sunset North Basin, Sutro, and University Mound North Basin. Recent and/or ongoing condition assessments and planning studies for dams, spillways, outlet works/valves, and/or other appurtenant facilities being implemented under the 10-year CIP include Pilarcitos Dam, San Andreas Dam, Cherry Valley Dam, Early Intake Dam, Lake Eleanor Dam, and O'Shaughnessy Dam. In addition, the Moccasin Lower Dam and spillways (including the main and auxiliary spillways) are currently being evaluated in the aftermath of the March 22, 2018, extreme storm event. Capital projects are planned for several of these facilities, and it is anticipated that additional capital projects will be needed to address potential dam safety issues revealed through the ongoing condition assessments and reevaluation of existing facilities in the coming years.

Appendix A: Asset Inventory Tables

Table A-1: Dams

Asset	Dam Type	Dam Height (feet)	County	Completion Date	DSOD Jurisdictional?
Upcountry					
O'Shaughnessy Dam	Concrete Gravity Arch	430	Tuolumne	1923/1938	Yes
Cherry Valley Dam	Earth and Rock	330	Tuolumne	1955	Yes
Early Intake Diversion Dam	Concrete Arch	81	Tuolumne	1924	Yes
Eleanor Dam	Concrete Buttressed Arch	70	Tuolumne	1918	Yes
Moccasin Dam	Earth and Rock	70	Tuolumne	1929	Yes
Priest Dam	Earth and Rock	160	Tuolumne	1923	Yes
Moccasin Upper Dam	Concrete-Gravity	30	Tuolumne County	1936	Yes, appurtenance to Moccasin Dam
Bay Area					
Calaveras Dam	Earth	220	Alameda	1925	Yes
Turner Dam	Earth	195	Alameda	1965	Yes
Upper Alameda Diversion Dam	Concrete Slab and Buttress	31	Alameda	1931	No
Lower Crystal Springs Dam	Concrete Gravity	163	San Mateo	1888/1890/1911	Yes
Upper Crystal Springs Dam	Earth	92.5	San Mateo	1877/1891	No
Pilarcitos Dam	Earth	95	San Mateo	1866/1867/1874	Yes
San Andreas Dam	Earth	105	San Mateo	1870/1875	Yes
San Mateo Creek Dam No. 1	Earth	20	San Mateo	1898	No
San Mateo Creek Dam No. 2	Concrete Arch	40	San Mateo	1898	No
Stone Dam	Masonry Arch	31	San Mateo	1871	No

Asset	Dam Type	Dam Height (feet)	County	Completion Date	DSOD Jurisdictional?
San Francisco					
Sunset North Dam	Earth	74	San Francisco	1938	Yes
Sunset South Dam	Earth	34	San Francisco	1960	Yes
University Mound North Basin	Earth	17	San Francisco	1885	Yes
University Mound South Basin	Earth	61	San Francisco	1937	Yes
Merced Manor Dam	Earth	23	San Francisco	1936	No

Note:
DSOD = Division of Safety of Dams

Table A-2: Groundwater Wells/Filter Galleries

Asset	Number of Wellheads	Location	Capacity
Bay Area			
Pleasanton Well Field	2	Pleasanton	< 1 mgd
Peninsula Conjunctive Use Wells (2019)	13	Various	~6.2 mgd
Sunol Filter Gallery		Sunol	7.4 mgd
Upcountry			
Cherry Valley Compound Well	1	Cherry Valley	3 to 7 gpm
O'Shaughnessy Backpacker Campground Well	1	O'Shaughnessy	6.8 gpm
O'Shaughnessy Dam Campground Well	1	O'Shaughnessy	30 gpm

Notes:
gpm = gallons per minute
mgd = million gallons per day

Table A-3: Supply Reservoirs

Asset	Capacity of Reservoir (ac-ft)	Reservoir Surface Area (sq. mi)	Location
Bay Area			
Calaveras Reservoir	96,800	2.2	Alameda County
San Antonio Reservoir	50,500	1.3	Alameda County
Crystal Springs Reservoir (Upper and Lower)	69,300	2.3	San Mateo County
Pilarcitos Reservoir	3,100	0.2	San Mateo County
San Andreas Reservoir	19,000	0.9	San Mateo County
Upcountry			
Early Intake Reservoir	115		Tuolumne County
Hetch Hetchy Reservoir	360,360[21]	3.1	Tuolumne County
Lake Eleanor	27,113[22]	1.5	Tuolumne County
Lake Lloyd (Cherry Valley Reservoir)	273,500	2.8	Tuolumne County
Moccasin Reservoir	552	0.05	Tuolumne County
Priest Regulating Reservoir	1,706	0.07	Tuolumne County

Notes:
ac-ft = acre feet
sq. mi = square miles

Table A-4: Treated Water Storage

Asset	Capacity (MG)	Location
Bay Area		
Town of Sunol (two tanks)	0.097 and 0.097	Sunol
Niles Reservoir	Decommissioned	Niles
Castlewood Reservoir	0.4	Pleasanton
Pulgas Balancing Reservoir	60	San Mateo
Merced Manor Reservoir	9.5	San Francisco
Sunset Reservoir – North Basin	89.4	San Francisco
Sunset Reservoir – South Basin	87.3	San Francisco
University Mound Reservoir – North Basin	59.4	San Francisco
University Mound Reservoir – South Basin	81.5	San Francisco
Upcountry		
Moccasin Domestic	0.088	Moccasin
Early Intake Domestic	0.044	Early Intake
Cherry Compound	0.066	Cherry
O'Shaughnessy Domestic	0.041	O'Shaughnessy

Note:
MG = million gallons

[21] Capacity with drum gates activated.
[22] Capacity with flashboards.

Table A-5: Water Treatment Facilities

Asset	Capacity(mgd)	Location
Bay Area		
TTF	315	Tracy/San Joaquin County
Thomas Shaft Facility	315	San Joaquin County
SVWTP	160	Alameda County
Sunol Chloramination Facility	--	Alameda County
HTWTP	160 maximum, 140 sustained	San Mateo County
Pulgas Dechloramination Facility	200	San Mateo County
Upcountry		
Rock River Lime Treatment Plant	400	Tuolumne County
Moccasin Camp UV Facility	0.47 per reactor (2)	Tuolumne County
Early Intake Camp UV Facility	0.47 per reactor (2)	Tuolumne County
O'Shaughnessy Compound UV Facility	0.17 per reactor (2)	Tuolumne County

Notes:

mgd = million gallons per day
HTWTP = Harry Tracy Water Treatment Plant
SVWTP = Sunol Valley Water Treatment Plant
TTF = Tesla Treatment Facility
UV = ultraviolet

Table A-6: Water Transmission – Pipelines and Tunnels

Asset	Size	Length (miles)	Flowrate (Design or Operating) (mgd)	Installation Date
Bay Area				
CRT	10.5′	25	400	1934
Alameda No. 1	69″	0.6	67	1934
Alameda No. 2	91″	0.6	134	1953
Alameda No. 3	96″	0.6	152	1967
Alameda No. 4	66″	0.6	160	2011
San Antonio Pipeline	60″	2.1	230	1967
SABPL	66″	1.3	230	2014
Calaveras Pipeline	44 to 72″	6	80	1965/1992
Irvington Tunnel No. 1	10.7′	3.5	400	1934
Irvington Tunnel No. 2	102″	3.5	400	2014
BDPL No. 1	60″	21.2	46	1925/1933
BDPL No. 2	66″	21.2	59	1935/1936
BDPL No. 3	72″	34	80	1952
BDPL No. 4	90″	34	80	1965/1967 1973
BDPL No. 5	East Bay: 72″ Peninsula: 60″	7 9	80 55	2011/2012
Bay Tunnel	9′	5	120	2014
Pulgas Tunnel	10.3-foot horseshoe	1.9		1924
Stanford Tunnel	90″	0.2	80	1949
Palo Alto Pipeline	12 to 36″	4.4		1938
Crystal Springs Bypass Tunnel	9.5′	3.4	215	1969
Crystal Springs Bypass Pipeline	96″	0.9	215	1970
New Crystal Springs Bypass Tunnel	96″	0.8	215	2011
SSPL	60″	13.4	111	1948-1958
CSPL No. 1	44″	17.1	10	1885/1956
CSPL No. 2	60″	19.3	52	1937/1956
CSPL No. 3	60″	3.6	60	1971/1987
SAPL No. 1	44″	12.5	22	1870-1939
SAPL No. 2	54″	12.3	37	1927-1928
SAPL No. 3	60 to 66″	6.6	65	1992/2014
Sunset Branch Pipeline	60″	1.1	65	1947
Crystal Springs-San Andreas Force main	61″	4.7	90	1898-1932 1968
Stone Dam Tunnel No. 1	4′-6″ by 4′-9″	0.1	45	1872-1948
Stone Dam Tunnel No. 2	3′-6″ by 4′-4″	0.61	45	1872-1948
San Mateo Tunnel No. 1	3′-6″ by 5′-1″	0.65	40	1868
San Mateo Tunnel No. 2	4′-4″ by 4′-6″	0.67	45	1898

Asset	Size	Length (miles)	Flowrate (Design or Operating) (mgd)	Installation Date
Upcountry				
Canyon Power Tunnel	14' by 14'-6" horseshoe	10.8	Design: 471	1965
Cherry Power Tunnel	12' by 12' horseshoe	5.5	Design: 523	1959
Early Intake Bypass	14' by 14'-6" horseshoe	0.38	NA	1967
Eleanor-Cherry Tunnel	10'-10" by 10'-10" horseshoe	1.1	Operating: 646	1960
Foothill Division Tunnel	13'-4" by 14'-3" horseshoe	16.4	400	1929
LCA		3.78	Operating: 107	1917
Moccasin Power Tunnel	13' by 13' horseshoe	1	Design: 801	1925
Moccasin Reservoir Bypass Pipeline	108"	0.39	Operating: 320	1972/1988
Mountain Division Tunnel	varies	19.2	Design: 400 at grade of 1.55:1000	1925
Red Mountain Bar Siphon	9.5'	0.48	400	1970
SJPL No. 1	56 to 72"	47.4	Operating: 75	1932
SJPL No. 2	61"	47.4	Operating: 80	1952
SJPL No. 3	78"	47.4	Operating: 150	1968
SJPL No. 4	78"	17.2	Operating: 150	2011-2013

Notes:
BDPL = Bay Division Pipeline
CRT = Coast Range Tunnel
CSPL = Crystal Springs Pipeline
LCA = Lower Cherry Aqueduct
mgd = million gallons per day
SABPL = San Antonio Backup Pipeline
SAPL = San Andreas Pipeline
SJPL = San Joaquin Pipeline
SSPL = Sunset Supply Pipeline

Table A-7: Water Transmission – Pump Stations

Asset	Number of Pumps	Total Capacity (mgd)	Location
Bay Area			
LMPS	5	65	San Francisco
Baden Pump Station	3	45	San Bruno
CSPS	4	120	San Mateo
Town of Sunol (potable)	2	0.72	Sunol
Sunol Pump Station	3	7.4	Sunol
Pulgas Pump Station	5	185	San Mateo
SAPS	8 (electric) 2 (diesel)	160	Sunol
Upcountry			
Cherry-Eleanor Pump Station	10	21.6	Tuolumne County

Notes:
CSPS = Crystal Springs Pump Station
mgd = million gallons per day
LMPS = Lake Merced Pump Station
SAPS = San Antonio Pump Station

Table A-8: Water Transmission – Valve Lots

Asset	Valves	Valve Size (inches)	Pipeline	Location
Bay Area				
Alameda Creek	V10 V11	60 by 84 60 by 84	ACDD ACDD	Sunol
AEP	X10 X20 X30 X32 X50 X55	72 72 60 60 54 54	AS2 AS3 AS1 AS1 AS4 AS4	Sunol
Alameda +SAPL + SABPL	W35 W41 W42Y X15 X23 X24Y X25 X35 X64 X71 X72 X73 X74 X75 X76 Y20 Y21 Y22 Y23 Y24 Y25 Y27 Y28 Y30 Y31 Y32 Y35 Y41 Y42 Y43 Y44	60 60 60 90 66 66 72 66 12 96 96 84 84 96 96 54 54 48 60 60 66 66 54 30 24 36 36 20 20 24 36	SAPL SABPL SABPL AS2 SABPL SABPL SABPL AS1 SUNOL PL AS4 AS1 AS2 AS1 AS3 AS1 SAPL SAPL SAPL SAPL SABPL SABPL SABPL SABPL SAPL SAPL SAPL SAPL SAPL SAPL SAPL SAPL	Sunol
AWP	X61 X62 X63 X85 X95	12 12 12 72 96	TOSPL TOSPL TOSPL AS2 AS4	Sunol

Asset	Valves	Valve Size (inches)	Pipeline	Location
Baden Valve Lot	K50	42	CSPL No. 2	South San Francisco
	K51M	36	CSPL No. 2	
	K54P	42	CSPL No. 2/SSPL	
	K54R	30	CSPL No. 2	
	M50	60	SSPL	
	M53R	30	SSPL/SAPL No. 2	
	M55P	42	SAPL No. 1/ CSPL No. 2	
	P57M	30	SAPL No. 1	
	P57R	42	CSPL No. 2	
	P59R	42	CSPL No. 2	
	R50	42	SAPL No. 2	
	R55	54	SAPL No. 2	
	R55K	36	SAPL No. 2/SAPL No. 3	
	R58P	42	SAPL No. 2/CSPL No. 2	
	T50	48	SAPL No. 3	
	T52R	42	SAPL No. 2/SAPL No. 3	
	T54M	42	SAPL No. 2/SAPL No. 3	
	T55	54	SAPL No. 3	
	T55P	16	CSPL No. 2/SAPL No. 3	
	T56R	42	SAPL No. 2/SAPL No. 3	
	T57P	42	CSPL No. 2	
	T58K	24	CSPL No. 2/SAPL No. 3	
Barron Creek	C34	72	BDPL No. 3	Palo Alto
	C36	72	BDPL No. 3	
	C35D	42	BDPL No. 3/BDPL No. 4	
	D34	90	BDPL No. 4	
	D36	90	BDPL No. 4	
Bear Gulch Valve Lot	C58	72	BDPL No. 3	Atherton
	C60	72	BDPL No. 3	
	D58	84	BDPL No. 4	
	D60	84	BDPL No. 4	
	C59D	42	BDPL No. 3/BDPL No. 4	
Bellevue and Pepper Valve Lot	M30	42	SSPL	Hillsborough
	M31	36	SSPL	
	M32K	36	CSPL No. 2/SSPL	
	M33L	36	CSPL No. 3/SSPL	
	L30	42	CSPL No. 3	
Calaveras Valve Lot	C20	66	BDPL No. 3	Milpitas
	C22D	48	BDPL No. 3/BDPL No. 4	
	C23D	48	BDPL No. 3/BDPL No. 4	
	D20	72	BDPL No. 4	

Asset	Valves	Valve Size (inches)	Pipeline	Location
Calaveras Reservoir	V21 V22 V23 V24 V25 V26 V27 V31 V33 V34 V37 V330 V397 V40 V41 V41A V41B V42 V43 V43A V43B V44 V442	30 48 48 60 30 48 48 72 72 48 24 42 66 66 16 16 16 66 36 36 36 66 66	Calaveras Dam Calaveras Dam Calaveras Dam Calaveras Dam Calaveras Dam Calaveras Dam Calaveras Dam Calaveras Dam Calaveras Dam CALPL CALPL CALPL CALPL CALPL CALPL CALPL CALPL CALPL CALPL CALPL CALPL CALPL	Sunol
Crystal Springs/ San Andreas	S49	36 by 48	CSPL/SAPL	San Bruno
Capuchino Valve Lot	M41 M41A M41B M43 M43A M43B	24 24 24 14 14 14	SSBPL SSBPL SSBPL SSBPL SSBPL SSBPL	San Bruno
Casey Quarry	M20	42	SSPL	Hillsborough
Crawford Valve Lot	C17 C18D C19 D17 D19	78 42 78 78 78	BDPL No. 3 BDPL No. 3/BDPL No. 4 BDPL No. 3 BDPL No. 4 BDPL No. 4	Fremont

Asset	Valves	Valve Size (inches)	Pipeline	Location
Crystal Spring Reservoir	H10 H11 H12 H20 H21 H22 H33 H53 H89 H91 H92 J61K J62K K60 K70 L40P L41K L59K L60 L70	42 42 42 42 42 42 60 42 60 66 by 60 66 by 60 24 24 48 48 30 42 44 44 44	LCS Outlet PL LCS Outlet PL LCS Outlet PL LCS Outlet PL LCS Outlet PL LCS Outlet PL LCS Outlet PL CSPL/SAPL DSOD Emerg. DSOD Emerg. CSPL No. 1/ CSPL No. 2 CSPL No. 1/ CSPL No. 2 CSPL No. 2 CSPL No. 2 CSPL No. 3/Millbrae Yard CSPL No. 3/Millbrae Yard CSPL No. 2/ CSPL No. 3 CSPL No. 1 CSPL No. 1	Crystal Spring
Crystal Springs and El Cerrito Valve Lot	K20	48	CSPL No. 2	Hillsborough
Davis Tunnel Diversion	S20	56 by52	Davis Tunnel	
Edgewood Road Valve Lot	A64D B65D B66C	24 24 20	BDPL No. 1/BDPL No. 4 BDPL No. 2/BDPL No. 4 BDPL No. 2/BDPL No. 3	San Mateo
Burlingame Valve Lot	K30	36	CSPL No. 2	Burlingame
El Camino Real/ Millbrae Yard Valve Lot	K38P K39P K40 K40P K41P M40 M42K	16 16 30 12 12 42 36	CSPL No. 2 SAPL No. 1 CSPL No. 2 CSPL No. 2 CSPL No. 2 SSPL SSPL/ CSPL No. 2	Millbrae
Grimmer Shutoff Station	A17 A18 A19 A191 A19B A19E A23B B17 B18 E15A	66 66 66 36 36 24 24 60 60 42	BDPL No. 2 BDPL No. 2 BDPL No. 2 BDPL No. 2 BDPL No. 1/BDPL No. 2 BDPL No. 2/BDPL No. 5 BDPL No. 1/BDPL No. 2 BDPL No. 1 BDPL No. 1 BDPL No. 2/BDPL No. 5	Hayward

Asset	Valves	Valve Size (inches)	Pipeline	Location
Guadalupe Valve Lot	C24	72	BDPL No. 3	Santa Clara
	C26	72	BDPL No. 3	
	C25D	42	BDPL No. 3/BDPL No. 4	
	D24	90	BDPL No. 4	
	D26	90	BDPL No. 4	
HTWTP	T10R	54	SAPL No. 3	San Bruno
	T11	66	SAPL No. 3	
	T12	20	SAPL No. 3	
	T20	42	SAPL No. 3	
Hillsborough Valve Lot	M15	78	SSPL	Hillsborough
	M21K	36	CSPL No. 2/SSPL	
	M22J	36	CSPL No. 2/SSPL	
Irvington Portal	A09	16	Hayward Serv.	Hayward
	A10	66	BDPL No. 2	
	B10	60	BDPL No. 1	
	C10	60	BDPL No. 3	
	D10	72	BDPL No. 4	
Hayward/EBMUD Intertie	A21	42	Hayward Intertie	Hayward
	A22	36	Hayward Intertie	
	A23	36	Hayward Intertie	
	A24	36	Hayward Intertie	
	B22	36	Hayward Intertie	
New Irvington Portal	A11	60	BDPL No. 2	Fremont (NIT)
	A11.1	16	Hayward Pipeline	
	A13E	24	BDPL No. 2/BDPL No. 5	
	B11	60	BDPL No. 1	
	C11	78	BDPL No. 3	
	D11	96	BDPL No. 4	
	E10	72	BDPL No. 2	
	E11	72	BDPL No. 5	
	H1	24	Hayward Pipeline	
	H2	24	NIT1 Manifold	
	H3	24	NIT1 to Hayward Pipeline	
	IT2-1	96	IT2	
Mountain View/ Alviso Valve Lot	C30	42	BDPL No. 3	Mountain View
	C31D	48	BDPL No. 3/BDPL No. 4	
	C32D	48	BDPL No. 3/BDPL No. 4	
	D30	72	BDPL No. 4	
Newark Tunnel Shaft	A20U	60	BDPL No. 2/BDPL No. 5	Fremont
	B20U	66	BDPL No. 1/BDPL No. 5	
	E15	72	BDPL No. 5	
	E20U	72	BDPL No. 5	
Palo Alto Pipeline	F40	36	PAPL	Palo Alto
	F45	36	PAPL	
	F50	24	PAPL	
	F60	12	PAPL	

Asset	Valves	Valve Size (inches)	Pipeline	Location
Paseo Padre Shutoff Station	A14	66	BDPL No. 2	Hayward
	A15	66	BDPL No. 2	
	A161	36	BDPL No. 2	
	A16B	36	BDPL No. 1/BDPL No. 2	
	B14	60	BDPL No. 1	
	B15	60	BDPL No. 1	
	E14	72	BDPL No. 5	
	E14A	42	BDPL No. 2/BDPL No. 5	
Pilarcitos Reservoir	S10	22	PIL	Pilarcitos
	S11	26 by 36	PIL	
	S12	26 by 36	PIL	
Ravenswood Tunnel Shaft	B50U	66	BDPL No. 5	Fremont
	E50U	60	BDPL No. 5	
	E52B	24	BDPL No. 2/BDPL No. 5	
Ravenswood Valve Lot Redwood City Valve Lot	A50U	60	BDPL No. 5	East Palo Alto Redwood City
	A60	42	BDPL No. 1	
	A61B	30	BDPL No. 1/BDPL No. 2	
	A62B	30	BDPL No. 1/BDPL No. 2	
	B60	48	BDPL No. 2	
	B62	48	BDPL No. 2	
	E10F	24	PAPL	
	E61	60	BDPL No. 5	
	E61B	42	BDPL No. 2/BDPL No. 5	
	E62	60	BDPL No. 5	
	F05	24	BDPL No. 1/BDPL No. 2	
	F06	24	PAPL	
	F10	20	PAPL	
	F20	20	PAPL	
	F25	24	PAPL	
	F30	30	PAPL	
Crystal Springs Bypass Tunnel/ Bypass Pipeline	G10	120 by 96	Pulgas Tunnel	San Mateo
	G11	120 by 120	Pulgas Tunnel	
	G12	42	Pulgas PS	
	G13	42?	Pulgas PS	
	G14	42	Pulgas PS	
	G15	42	Pulgas PS	
	G16	42?	Pulgas PS	
	G17	42?	Pulgas PS	
	G18	18	Pulgas Balancing Res.	
	G18A	84	Pulgas Balancing Res.	
	G20	120 by 120	CSBT	
	G32	96	NCSBT	
	G34	96	CSBPL	
	G36	78	NCSBT/SSPL	
	G38	60	NCSBPL/CSPL No. 2	
	G40	72	CSBPL/SSPL and CSPL No. 2	
	G41	54	CSBPL/SSPL	
	G42	42	CSBPL/CSPL No.2	

Asset	Valves	Valve Size (inches)	Pipeline	Location
CSPS	H81	72	CSOS No. 1	San Mateo
	H82	72	CSOS No. 1	
	H83	60	CSPS- CSPL/SAPL	
	H84	60	Reservoir – Potable Pipeline	
	H85	60	CSPS Suction	
	H86	36	CSPS Disc. to	
	H87	72	Potable Pipeline	
	H97	42	SSPL	
	H98	42	SSPL	
	H99	42	SSPL	
	J10	12	CSPL No. 2	
	J11	12	CSPL No. 2	
	K10	60	CSPL No. 2	
	M10	60	SSPL	
San Andreas Reservoir	N20	54	SAPL No. 2RW	San Bruno
	N21	54	SAPL No. 2RW	
	N30	42	SAPL No. 3RW	
	N31	48	SAPL No. 3RW	
	N32	48	SAPL No. 3RW	
	N33	48	SAPL No. 3RW	
	N40	54	SAPL No. 2	
	N41	60	SAPL No. 3RW	
	N49	12	SAPL No. 3RW	
	N50	54	SAPL No. 3RW	
	N51	60	SAPL No. 3RW	
	N69	96	HTWTP Treated Water	
	N72	96	HTWTP Treated Water	
	N74	78	SSBPL	
	P10	24	SAPL No. 1	
	P48	44	SAPL No. 1	
	R10	36	SAPL No. 2	
	R11	54	SAPL No. 2	
	R12	54	SAPL No. 2	
	R20	42	SAPL No. 2	
Pulgas Valve Lot	A68	42	BDPL No. 1	San Mateo
	A70	24	BDPL No. 1	
	B68	42	BDPL No. 2	
	B70	42	BDPL No. 2	
	C68	48	BDPL No. 3	
	C70	48	BDPL No. 3	
	D68	72	BDPL No. 4	
	D70	72	BDPL No. 4	
	E68	60	BDPL No. 5	
	E70	60	BDPL No. 5	

Asset	Valves	Valve Size (inches)	Pipeline	Location
SAPS Valve Lot	X11	20	SVWTP Eff.	Sunol
	X111	20	SVWTP Eff.	
	X112	20	SVWTP Eff.	
	X12	60	SVWTP Eff.	
	X14	66	AS2	
	X22	60	SVWTP Eff.	
	W11	54	CALPL	
	W12	66	CALPL	
	W15	36	San Antonio Pipeline	
	W20	60	SVWTP Eff.	
	W21	54	SVWTP Eff.	
	W22	54	SVWTP Eff.	
	W30	60	San Antonio Pipeline	
	W31	42	San Antonio Pipeline	
	W32	60	San Antonio Pipeline	
	W33	60	San Antonio Pipeline	
San Antonio Reservoir	Y01	36	San Antonio Pipeline	Sunol
	Y02	36	San Antonio Pipeline	
	Y03	36	San Antonio Pipeline	
	Y04	36	San Antonio Pipeline	
	Y05	36	San Antonio Pipeline	
San Mateo Creek Dam	S13	36 by 36	San Mateo Tunnel No. 1	
	S30	36 by 36	San Mateo Tunnel No. 2	
	S31	39 by 18	San Mateo Tunnel No. 2	
	S32	39 by 18	San Mateo Tunnel No. 2	
	S33	39 by 18	San Mateo Tunnel No. 2	
	S40	30	San Mateo Tunnel No. 2	
San Pedro Valve Lot	M60	42	SSPL	Colma
	T60	48	SAPL No. 3	
	T61M	36	SAPL No. 3/SSPL	
	T62R	30	SAPL No. 3/SAPL No. 2	
	T63R	30	SAPL No. 3/SAPL No. 2	
	T64M	36	SAPL No. 3/SSPL	
	R59	42	SAPL No. 2	
	R60	42	SAPL No. 2	
Stanford East Portal	C40	48	BDPL No. 3	Palo Alto
	D40	72	BDPL No. 4	
SFWD/SCVWD	C23.1	42	BDPL No. 3	Santa Clara
	C23.2	42	BDPL No. 3	
	C23.3	42	BDPL No. 3/BDPL No. 4	
	D23.1	42	BDPL No. 4	
	D23.2	42	BDPL No. 4	
Stanford West Portal	C50	48	BDPL No. 3	Palo Alto
	D50	72	BDPL No. 4	
Stone Dam	S60	22	Stone Dam	Stone Dam
	S61	48 by 48	Stone Dam	
Sunset Branch Pipeline	N75	78	SSBPL	San Bruno

Asset	Valves	Valve Size (inches)	Pipeline	Location
SVWTP	W10 W40	42 60	CALPL San Antonio PL	Sunol
Tissiack Valve Lot	C14 D14 C15D C16 D16	78 78 42 78 78	BDPL No. 3 BDPL No. 4 BDPL No. 3/BDPL No. 4 BDPL No. 3 BDPL No. 4	Fremont
Upcountry				
Canyon Portal Valve House	CPVH BFV	96	KPH Penstock	Early Intake
Eleanor Release Valves	SG 1 SG 2 G 3 G 4	24 24 24 24	Eleanor Creek	Eleanor
Early Intake Dam	SG 1 SG 2	36 36	Tuolumne River	Early Intake
Cherry-Eleanor Tunnel	SG A SG B	72 by 96 72 by 96	Cherry-Eleanor Tunnel	Cherry Pump Station
Mountain Tunnel Headgates	HG 2 HG 3 HG 4	48 by 60 48 by 60 48 by 60	Mountain Tunnel	Early Intake
Cherry Valley Dam	FCV 1 and FCV 2 JFV 1 and JFV 2 12-inch Needle BFV 1 and BFV 2 BFV 3	66 18 12 84 84	Cherry Creek Cherry Power Tunnel	Cherry Valve House
Emery Crossover Valves	EC-EXO101 EC-EXO201 EC-EXO301 EC-EXO102 EC-EXO202 EC-EXO302 EC-EXOUX12 EC-EXOUX23 EC-EXODX12 EC-EXODX23	60 60 72 60 60 72 36 42 30 36	SJPL No. 1 SJPL No. 2 SJPL No. 3 SJPL No. 1 SJPL No. 2 SJPL No. 3 SJPL Nos. 1 and 2 SJPL Nos. 2 and 3 SJPL Nos. 1 and 2 SJPL Nos. 2 and 3	Stanislaus County
Granite Portal Valve House	BFV	94	HPH Penstock	Tuolumne County
Oakdale Portal Valve House	ODP101 ODP201 ODP301 ODP401	60 60 78 78	SJPL No. 1 SJPL No. 2 SJPL No. 3 SJPL No. 4	Tuolumne County

Asset	Valves	Valve Size (inches)	Pipeline	Location
O'Shaughnessy Dam	V1	72	Tuolumne River	O'Shaughnessy Dam
	V2	75	Canyon Power Tunnel	
	V3 through V8	60		
	V12 and V13	36		
	V15 and V16	60		
West Portal Valve House	BFV 1 and BFV 2	104	Moccasin Penstock	West Portal
Pelican Crossover Valves	PC-PXO101	60	SJPL No. 1	Vernalis
	PC-PXO201	60	SJPL No. 2	
	PC-PXO301	72	SJPL No. 3	
	PC-PXO102	60	SJPL No. 1	
	PC-PXO202	60	SJPL No. 2	
	PC-PXO302	72	SJPL No. 3	
	PC-PXO402	72	SJPL No. 4	
	PC-PXOUX12	36	SJPL Nos. 1 and 2	
	PC-PXOUX23	42	SJPL Nos. 2 and 3	
	PC-PXODX12	30	SJPL Nos. 1 and 2	
	PC-PXODX23	36	SJPL Nos. 2 and 3	
	PC-PXODX34	36	SJPL Nos. 3 and 4	
Roselle Crossover Valves	RC-RXO101	60	SJPL No. 1	Riverbank
	RC-RXO201	60	SJPL No. 2	
	RC-RXO301	72	SJPL No. 3	
	RC-RXO102	60	SJPL No. 1	
	RC-RXO202	60	SJPL No. 2	
	RC-RXO302	72	SJPL No. 3	
	RC-RXOUX12	36	SJPL Nos. 1 and 2	
	RC-RXOUX23	42	SJPL Nos. 2 and 3	
	RC-RXODX12	30	SJPL Nos. 1 and 2	
	RC-RXODX23	36	SJPL Nos. 2 and 3	
SJPL No. 4 Tie-In Vault	P4J301	60	SJPL No. 3	Stanislaus County
	P4J401	60	SJPL No. 4	
SJPL Nos. 3 and 4 Throttling Station	T3E331	36	SJPL No. 3	Stanislaus County
	T3E301	72	SJPL No. 3	
	T4E431	36	SJPL No. 4	
	T4E401	72	SJPL No. 4	
SJPL No. 2 Throttling Station T2E	T2E201	48	SJPL No. 2	Stanislaus County
	T2E231	30	SJPL No. 2	
SJPL No. 2 Throttling Station T2W	T2W201	48	SJPL No. 2	Stanislaus County
	T2W231	30	SJPL No. 2	

Asset	Valves	Valve Size (inches)	Pipeline	Location
San Joaquin River Valve House	SJV331	42	SJPL No. 3	Stanislaus County
	SJV311	42	SJPL No. 3	
	SJV212	20	SJPL No. 2	
	SJV231	30	SJPL No. 2	
	SJV211	30	SJPL No. 2	
	SJV131	30	SJPL No. 1	
	SJV112	18	SJPL No. 1	
	SJV113	24	SJPL No. 1	
Tesla UV Valve House	TUV101	60	SJPL No. 1	San Joaquin County
	TUV201	60	SJPL No. 2	
	TUV301	78	SJPL No. 3	
	TUV401	78	SJPL No. 4	
Tesla Portal Valve House	TPV101	60	SJPL No. 1	San Joaquin County
	TPV201	60	SJPL No. 2	
	TPV301	78	SJPL No. 3	

Notes:
ACDD = Alameda Creek Diversion Dam
AS = Alameda Siphon
AWP = Alameda West Portal
BDPL = Bay Division Pipeline
BFV = butterfly valve
CALPL = Calaveras Pipeline
CSBPL = Crystal Springs Bypass Pipeline
CSBT = Crystal Springs Bypass Tunnel
CSOS = Crystal Springs Outlet Structure
CSPL = Crystal Springs Pipeline
CSPS = Crystal Springs Pump Station
DSOD = Division of Safety of Dams
EBMUD = East Bay Municipal Utility District
HTWTP = Harry Tracy Water Treatment Plant
LCS = Lower Crystal Springs
NCSBPL = New Crystal Springs Bypass Pipeline
NCSBT = New Crystal Springs Bypass Tunnel
NIT = New Irvington Tunnel
PAPL = Palo Alto Pipeline
PIL = Pilarcitos Dam Pipeline
Pulgas PS = Pulgas Pump Station
SABPL = San Antonio Backup Pipeline
SAPL = San Andreas Pipeline
SCVWD = Santa Clara Valley Water District
SFWD = San Francisco Water Department
SJPL = San Joaquin Pipeline
SSBPL = Sunset Branch Pipeline
SSPL = Sunset Supply Pipeline
TOSPL = Town of Sunol Pipeline
SVWTP = Sunol Valley Water Treatment Plant
UV = ultraviolet

Table A-9: Water Transmission – Interties

Asset	Capacity (mgd)	Location
Bay Area		
DWR	50	Sunol
EBMUD	30 mgd to/from EBMUD 15 mgd to/from the SFPUC 15 mgd to City of Hayward	Hayward
SCVWD	40	Milpitas

Notes:
DWR = California Department of Water Resources
EBMUD = East Bay Municipal Utility District
mgd = million gallons per day
SCVWD = Santa Clara Valley Water District
SFPUC = San Francisco Public Utilities Commission

Table A-10: Water Transmission – Town of Sunol Distribution System

Asset	Size (inches)	Total Length (miles)	Capacity (mgd)
Bay Area			
Town of Sunol Distribution System	4″ 6″ 8″ 2″	0.75 0.66 0.2 0.7	0.15
Upcountry			
Moccasin Camp	N/A	N/A	N/A
Early Intake Camp	N/A	N/A	N/A
O'Shaughnessy Compound	N/A	N/A	N/A
Cherry Valley Compound	N/A	N/A	N/A

Notes:
mgd = million gallons per day
N/A = not applicable

Table A-11: Watershed and Lands Management – Watersheds

Asset	Size of Hydrologic Watershed (sq. mi)	Location
Bay Area		
Calaveras Watershed	135	Alameda and Santa Clara Counties
Crystal Springs Watershed	24.8	San Mateo County
Pilarcitos Watershed	3.8	San Mateo County
San Andreas Watershed	4.1	San Mateo County
San Antonio Watershed	40	Alameda County
Upcountry		
Early Intake Watershed	29	Tuolumne County
Hetch Hetchy Watershed	459	Tuolumne County
Moccasin Watershed	0	Tuolumne County
Lake Eleanor Watershed	79	Tuolumne County
Lake Lloyd Watershed	114	Tuolumne County
Lower Cherry Diversion Dam Watershed	32	Tuolumne County
Priest Watershed	2.8	Tuolumne County

Note:
sq. mi = square miles

Table A-12: Powerhouses

Asset	Power Output at Full Reservoir (MW)	Draft (mgd)	Location	Completion Date
Upcountry				
Kirkwood Powerhouse	125	820	Tuolumne County	1964
Moccasin Powerhouse	110	860	Tuolumne County	1925/1969
Moccasin Low Head Powerhouse	2.9	265	Tuolumne County	1986

Notes:
mgd = million gallons per day
MW = megawatt

Table A-13: Penstocks

Asset	Total Length (miles)	Location	Completion Date
Upcountry			
Kirkwood Penstock	0.37	Tuolumne County	1964
Moccasin Penstock	1.1	Tuolumne County	1925/portions in 1969
Moccasin Low Head Penstock	0.5	Tuolumne County	1986

Table A-14: Watershed and Lands Management – Structures (Non-Operations)

Asset	Status	Type	Location
Bay Area			
North San Andreas Cottage	Active	Watershed Resources Manager Residence	San Mateo County
San Andreas Cottage	Inactive	Watershed Keeper Residence	San Mateo County
Sawyer Camp Cottage	Active	Watershed Keeper Residence	San Mateo County
Pilarcitos Cottage	Active	Watershed Keeper Residence	San Mateo County
Davis Tunnel Cottage	Active	Watershed Keeper Residence	San Mateo County
Lower Crystal Springs Cottage	Inactive	Watershed Keeper Residence	San Mateo County
Cypress Work Center	Active	Former Cottage – now Natural Resources offices, work and meeting center	San Mateo County
Upper Crystal Springs Cottage	Active	Watershed Keeper Residence	San Mateo County
Crystal Springs Cottage	Active	Watershed Keeper Residence	San Mateo County
Niles Cottage	Decommissioned	Watershed Keeper Residence	Alameda County
Sunol Yard Cottage	Decommissioned	Watershed Keeper Residence	Alameda County
Irvington Cottage	Active	Watershed Keeper Residence	Alameda County
San Antonio Cottage	Active	Watershed Keeper Residence	Alameda County
Alameda East Cottage	Active	Watershed Keeper Residence	Alameda County
Calaveras No. 1 Cottage	Inactive	Watershed Keeper Residence	Alameda County
Calaveras No. 2 Cottage	Decommissioned	Watershed Keeper Residence	Alameda County
Polhemus Fluoride Building	Active	Emergency Supply Stockpile and Staging Site	San Mateo County
Mt. Allison	Active	Radio Repeater Site	San Mateo County
Sawyer Ridge	Active	Radio Repeater Site	Alameda County
Pulgas Water Temple	Active	Public Grounds	San Mateo County
Sunol Water Temple	Active	Public Grounds	Alameda County
Tesla Cottage	Active	Operators Residence	San Joaquin County
Andrade Road Cottage	Active	Watershed Keeper Residence	Alameda County

Asset	Status	Type	Location
Upcountry			
O'Shaughnessy Office and cottages	Active	Office, other, residence for HHWP essential personnel and NPS	Tuolumne County
O'Shaughnessy UV Treatment Plant	Active	Water treatment	Tuolumne County
Early Intake Cottages and Bunkhouse	Active	Office, other, residence for HHWP essential personnel and NPS	Tuolumne County
Kirkwood Powerhouse	Active	Powerhouse	Tuolumne County
Holm Powerhouse	Active	Powerhouse	Tuolumne County
Canyon Portal Valvehouse	Active	Valvehouse	Tuolumne County
Granite Portal Valvehouse	Active	Valvehouse	Tuolumne County
Cherry Creek Diversion Dam Structures	Active	Gatehouse	Tuolumne County
Lake Eleanor Cottage and Bunkhouse	Active	Office and residence for NPS	Tuolumne County
Cherry Cottages and Bunkhouse	Active	Office, residence for HHWP essential personnel, USFS, NPS	Tuolumne County
Cherry Valvehouse	Active	Valvehouse	Tuolumne County
Burnout Ridge Radio Site	Active	Radio Site	Tuolumne County
Intake Ridge Radio Site	Active	Radio Site	Tuolumne County
Poopenaut Pass Radio Site	Active	Radio Site	Tuolumne County
Cherry Compound Memocor	Active	Water treatment	Tuolumne County
Early Intake UV Treatment Plant	Active	Water treatment	Tuolumne County
Duckwall Radio Site	Active	Radio Site	Tuolumne County
Albers Road Valve House	Active	Valvehouse	Stanislaus County
Alameda Valvehouse	Active	Valvehouse	Alameda County
Cashman Creek Valve House	Active	Valvehouse	Stanislaus County
Emery Road Crossover Auxiliary Control Building	Active	Valvehouse	Stanislaus County
Emery Road Crossover Valve House	Active	Valvehouse	Stanislaus County
Intake Switchyard Control Building	Active	Power transmission control	Tuolumne County
Mather Cabins	Active	Other and residence for NPS	Tuolumne County
Moccasin Camp Offices and Cottages	Active	Office, other, residence for HHWP essential personnel	Tuolumne County
Moccasin Powerhouse	Active	Powerhouse	Tuolumne County
Moccasin UV Treatment Plant	Active	Water treatment	Tuolumne County

Asset	Status	Type	Location
Moccasin Peak Radio Site	Active	Radio Site	Tuolumne County
Oakdale Office	Active	Office	Stanislaus County
Oakdale Portal Valvehouses	Active	Valvehouse	Stanislaus County
Pelican Crossover Valvehouse	Active	Valvehouse	Stanislaus County
Roselle Crossover Valvehouse	Active	Valvehouse	Stanislaus County
Rock River Cottage	Active	Residence for HHWP essential personnel	Tuolumne County
Rock River Lime Plant	Active	Water treatment	Tuolumne County
San Joaquin Valvehouse	Active	Valvehouse	Stanislaus County
Priest Cottage	Active	Residence for HHWP essential personnel	Tuolumne County
West Portal Cottage	Active	Residence for HHWP essential personnel	Tuolumne County
South Fork Yard Office and Building	Active	Office and shop	Tuolumne County
Tesla Chlorination Building	Active	Water treatment	San Joaquin County
Tesla Portal Valvehouses	Active	Valvehouse	San Joaquin County
West Portal Valvehouse	Active	Valvehouse	Tuolumne County
Old Moccasin Powerhouse	Not Active	vacant	Tuolumne County
Warnerville Switchyard Control Building	Active	Power transmission control	Stanislaus County
Warnerville Cottages	Active	Residence for HHWP essential personnel	Stanislaus County
Warnerville Shops	Active	Office and shop	Stanislaus County

Notes:
HHWP = Hetch Hetchy Water and Power
NPS = National Park Service
UV = ultraviolet
USFS = United States Forest Service

Table A-15: Buildings and Watersheds – Quarries

Asset	Size (acres)	Location	Purpose
Bay Area			
Casey Quarry	1	San Mateo County	
Skyline Quarry	16	San Mateo County	Emergency Supply Stockpile and Staging
Donovan Quarry	66	Redwood City	Emergency Supply Stockpile

Table A-16: Buildings and Grounds – Corporation Yards

Asset	Size (acres)	Location
Bay Area		
Millbrae Corporation Yard	10	Millbrae
Sunol Corporation Yard	25	Sunol
Rollins Facility	3	Burlingame
Upcountry		
Moccasin	6	Moccasin
South Fork Maintenance Yard	1.5	Tuolumne County
Warnerville Yard	2	Oakdale
Oakdale Yard	NA	Oakdale

Table A-17: Rolling Stock

Asset	Quantity	
	Bay Area	Upcountry
Passenger Cars	21	0
Light Duty Trucks, SUVs, Vans	215	115
Heavy Equipment	64	26
Trailer Equipment, Equipment on Trailers	59	62
Other Equipment – Boats	94	24
Medium and Heavy Duty Trucks	25	20

Table A-18: Seismic Upgrades

Facility	Date of Completion	Seismic Upgrade
Bay Area		
Tesla Portal	2011	New chemical feed facilities.
Thomas Shaft Chlorination Facility	2011	Built to recent seismic standards, with SCADA remote control. New vent structure.
AEP	2011	Seismically upgraded portal with new Alameda Siphon Nos. 2, 3, and 4 connections. New CRT ventilation system. New overflow pipeline.
Alameda Siphons	2011	New seismically upgraded siphon (No. 4). Seismically upgraded siphons from mixing chamber to AWP. Seismically activated isolation valves. New chemical injection facilities
SVWTP	2013	Structural and worker safety upgrades and seismic closure valves on all chemical tanks. New emergency generator and fuel tank. Expansion improvements to increase sustainable capacity. New treated-water reservoir and chlorine contact tank. New chemical storage and feed facilities. New plant discharge-associated piping.
Sunol Yard	2008	Pipe-rolling facility for emergency pipeline repair.
SAPS	2011	Seismic upgrades for worker safety. Emergency generator for electric pumps. Replacement of three electrical pump casings.
San Antonio Reservoir	2010	SCADA-controlled reservoir outlet closure system.
Calaveras Reservoir	2018	New dam, outlet structure, and spillway.
NIT	2015	Remote-controlled valve actuators. Emergency generator.
BDPLs	2011 2011 2007 2012 2011 2012	Seismic upgrade at Hayward Fault, including automatic shutoff valves and reinforced pipeline (Nos. 1 and 2). Flexible hose connection manifolds across Hayward Fault (Nos. 1 and 2). Hydraulic Isolation Valves at Hayward Fault (Nos. 3 and 4). Crossover facilities between Nos. 3 and 4 at Barron Creek, Guadalupe River, and Bear Gulch. New East Bay pipeline (No. 5). New Peninsula pipeline (No. 5).

Facility	Date of Completion	Seismic Upgrade
	2012 2012 2014 2014	New crossover facilities, isolation valves, and interconnections (No. 5). New control building and emergency generators. New Bay Tunnel. Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault.
EBMUD Intertie	2007	New piping, valving, and pump station, including emergency generator.
SCVWD Intertie	2004	New piping, valving, and pump station, including emergency generator.
Pulgas Valve Lot	2012	Secondary line valves with SCADA remote control. New generator.
Pulgas Reservoir/ Pump Station	2009	Redundant discharge valve.
Pulgas Discharge Channel	2009	Seismic upgrade.
Pulgas Balancing Reservoir	2011	Seismic upgrade to walls and roof.
Pulgas Dechlor Facility	2012	New common inlet and outlet piping. Improvements to process control and chemical feed systems and sampling systems.
LCSD Improvements	2012	Seismic improvement to dam.
HTWTP	2015	Chemical tank seismic closure valves. Seismic structural upgrades to filters. Employee safety seismic upgrades.
New Crystal Springs Bypass Tunnel	2011	New tunnel under fault slip and landslide zone. New isolation valves and vaults. New standby power.
Capuchino Valve Lot	2008	New isolation valves and actuators. Valve vault repairs. New instrumentation and control systems. High-pressure zone supply to low-pressure zone.
PPSU	2015 2015 2017	Phase 1 – Serra Fault and Colma Creek mitigation measures. Phase 2 – New isolation valves and actuators. Phase 3 – New isolation valves and mitigation of liquefaction in Stern Grove.
Baden Valve Lot/ Pump Station	2011	Emergency generators. New pressure-reducing valves for redundant high-pressure zone supply to low-pressure zone. New isolation valves. Seismic upgrade.

Facility	Date of Completion	Seismic Upgrade
Millbrae Corporation Yard and Laboratory	2010	Emergency generator and seismic upgrade.
San Pedro Valve Lot	2011	Seismic upgrade.
Sunset Reservoir North Basin	2008	Seismic upgrade of north basin.
University Mound North Reservoir	2011	Seismic upgrade of north basin.
Upcountry		
None in 2017/2018		

Notes:

AEP = Alameda East Portal
AWP = Alameda West Portal
BDPL = Bay Division Pipeline
CRT = Coast Range Tunnel
LCSD = Lower Crystal Springs Dam
NIT = New Irvington Tunnel
SAPS = San Antonio Pump Station
SCADA = Supervisory Control and Data Acquisition
SVWTP = Sunol Valley Water Treatment Plant

Appendix B: Emergency Response and Preparedness Plans

Listed below are the relevant emergency response plans that directly relate to the RWS. Plans not listed below include state-level plans, county-level plans, and some division- or bureau-specific contingency plans.

Table B-1: Relevant Emergency Response Plans for the Regional Water System

Plan	Draft/Revision Date	Last Exercised
Regional Water System Emergency Pipeline Repair Recovery and Readiness Program	2004	2015
City and County of San Francisco Emergency Response Plan	2017	2017
Risk Management Plan – California Accident Release Prevention Program for HTWTP	2017	Reviewed July 2018
Risk Management Plan – California Accident Release Prevention Program for Sunol Valley Water Treatment Plant	2018	Reviewed July 2018
Risk Management Plan – California Accident Release Prevention Program for Sunol Valley Chloramination Facility	2018	Reviewed July 2018
Cryptosporidium Detection Action Plan	2015	2009; urgency decreased with HH UV treatment at Tesla
Spill Prevention, Control, and Countermeasure Plan – San Antonio Pump Station	2017	December 2017
Sunol Valley Chloramination Facility and Water Treatment Plant Hazardous Materials Business Plans	2018	October 2016
Water Quality Notifications and Communications Plan (Rev. 6)	2017	June 2018
Water Contamination and Response and Consequence Management Plan	2016	2012
Regional Water System Emergency Disinfection and Recovery Plan	2013	2016
SFPUC Emergency Operations Plan	Overall EOP – 2012 WSTD DEOP – 2013	Water Enterprise portion (all divisions) – June 2017

Plan	Draft/Revision Date	Last Exercised
	WQD DEOP – 2016 NRLMDD DEOP and FOG – 2014 HHWP DEOP – 2013 CDD DEOP – 2013	HHWP portion – August 2018 CDD portion – February 2017 WSTD portion – June 2018 WQD portion – April 2016 NRLMD portion – June 2017
Water Supply and Treatment Division Emergency Operations Plan	2013	June 2017
Natural Resources and Lands Management Division Emergency Operations Plan	2013	July 2017
SFPUC Continuity of Operations Plan and Annexes	Enterprise: 2014 IT: 2017	Enterprise: 2014 IT: 2017
Mountain Tunnel Emergency Restoration Plan	2014	March 2017
Emergency Action Plans – DSOD Jurisdictional Dams	2017	Turner Dam: May 3, 2017 Calaveras Dam – September 20, 2018 O'Shaughnessy Dam – October 11, 2017 Moccasin Dam – March 22, 2018 Summit Dam – March 15, 2018 Lake Eleanor – September 21, 2016
Water Quality Division Emergency Operations Plan and supplemental Field Operations Guide	2016	2016
Moccasin Overflow Emergency Response Plan – Moccasin Wastewater Treatment Plant	2016 Reviewed March 2018	

Notes:
DSOD = Division of Safety of Dams
HTWTP = Harry Tracy Water Treatment Plant
SFPUC = San Francisco Public Utilities Commission

Appendix C: Condition Assessment Priorities

Table C-1: Facility Assessment Program Schedule

Nonlinear Asset Tier	Asset Name	Asset Class	Completion Date of Last Assessment	Scheduled Date of Next Assessment[23]	Number of Assets in MAXIMO	Number of Assets in MAXIMO w/ PM	Notes
1	TTF	Treatment Plant	June 2018	July 2021	651	546	Overhaul of UV Reactors.
1	Baden Pump Station	Pump Station	July 2016	July 2019	204	82	Significant upgrades performed under the WSIP.
1	Pulgas Dechloramination Facility	Field Facility	August 2014	August 2017	317	93	
1	Pulgas Pump Station	Pump Station	September 2014	September 2017	91	55	
1	AEP	Tunnel/Pipeline	June 2009	October 2017	47	18	
1	AWP	Tunnel/Pipeline	June 2009	October 2014	36	14	
1	SAPS	Pump Station	November 2017	November 2020	188	105	Capital project to upgrade the MCCs and the dividing wall between bldgs.
1	Pulgas Balancing Reservoir	Reservoir	August 2012	December 2018	1	0	Significant upgrades performed under the WSIP.
1	Pulgas Valve Lot	Valve Lot	June 2009	December 2017	62	32	
1	San Pedro Valve Lot	Valve Lot	November 2010	January 2018	32	16	Significant upgrades performed under the WSIP.
1	Baden Valve Lot	Valve Lot	December 2011	January 2018	36	33	
1	San Antonio Dechlorination Facility	Field Facility	June 2009	July 2019	30	1	WSIP to commission bldg. through JOC

[23] Some dates have already passed due to lack of Planning and System Operations staff to plan and support condition assessments. Based on availability, Tier 1 assets will be addressed before assets in Tiers 2 and 3.

Nonlinear Asset Tier	Asset Name	Asset Class	Completion Date of Last Assessment	Scheduled Date of Next Assessment[23]	Number of Assets in MAXIMO	Number of Assets in MAXIMO w/ PM	Notes
1	SVWTP	Treatment Plant	February 2018	February 2021	2186	634	Further capital upgrades needed for operational reliability.
1	SVCF	Field Facility	January 2016	March 2019	273	109	
1	HTWTP	Treatment Plant	March 2015	May 2020	3281	1359	
1	Thomas Shaft	Field Facility	March 2016	TBD	121	19	
1	New CSPS	Pump Station	May 2014	TBD	92	86	Not currently scheduled until after construction.
2	Millbrae Yard	Corporation Yard	July 2017	TBD	219	113	
2	Sunol Yard	Corporation Yard	Under Construction	TBD	63	38	
1	Upper Alameda Creek Diversion Dam	Dam	Under Construction	TBD	5	2	Not currently scheduled until after construction.
1	Calaveras Dam	Dam	Under Construction	TBD	13	8	Not currently scheduled until after construction.
1	Crystal Springs Dam	Dam	April 2018	TBD	4	2	Significant upgrades performed under the WSIP.
1	Pilarcitos Dam	Dam	September 2017	TBD	6	1	Annual inspection, in accordance with the DSOD.
1	San Andreas Dam	Dam	September 2017	TBD	8	7	Annual inspection, in accordance with the DSOD.
1	Stone Dam	Dam	July 2016	July 2017	2	1	Not under DSOD jurisdiction.
1	Turner Dam	Dam	October 2017	TBD	8	4	Annual inspection, in accordance with the DSOD.
2	Lawrence Livermore Laboratory Site 300 Treatment Facility	Field Facility	May 2010	May 2017	16	10	
2	EBMUD Intertie	Intertie	March 2011	March 2017	2	0	

Nonlinear Asset Tier	Asset Name	Asset Class	Completion Date of Last Assessment	Scheduled Date of Next Assessment[23]	Number of Assets in MAXIMO	Number of Assets in MAXIMO w/ PM	Notes
2	SCVWD Intertie	Intertie	January 2011	January 2017	185	15	
2	Calaveras Reservoir	Reservoir	–	–	62	19	Daily inspections by watershed staff.
2	Lower Crystal Springs Reservoir	Reservoir	–	–	19	13	Daily inspections by watershed staff.
2	Pilarcitos Reservoir	Reservoir	–	–	24	14	Daily inspections by watershed staff.
2	San Andreas Reservoir	Reservoir	–	–	11	9	Daily inspections by watershed staff.
2	San Antonio Reservoir	Reservoir	–	–	19	10	Daily inspections by watershed staff.
2	UCSR	Reservoir	–	–	2	1	Daily inspections by watershed staff.
2	Mount Allison Radio Station	Structure (non op)	August 2010	August 2017	0	0	
2	Sawyer Ridge Radio Station	Structure (non op)	August 2010	August 2017	7	3	
2	Bellevue and Pepper Valve Lot	Valve Lot	August 2010	August 2017	27	16	
2	Caisson	Valve Lot	August 2010	August 2017	11	7	
2	Calaveras Valve Lot	Valve Lot	August 2010	August 2017	3	3	
2	Capuchino Valve Lot	Valve Lot	August 2010	August 2017	27	14	
2	Crawford Valve Lot	Valve Lot	August 2010	August 2017	6	0	
2	Dumbarton Valve Lot	Valve Lot	August 2010	August 2017	10	9	
2	Edgewood Road Valve Lot	Valve Lot	October 2010	October 2017	2	1	
2	Geneva Valve Lot	Valve Lot	October 2010	October 2017	8	3	
2	Grimmer Shutoff Station	Valve Lot	October 2010	October 2017	6	0	
2	Mountain View/Alviso Valve Lot	Valve Lot	October 2010	October 2017	7	1	

Nonlinear Asset Tier	Asset Name	Asset Class	Completion Date of Last Assessment	Scheduled Date of Next Assessment[23]	Number of Assets in MAXIMO	Number of Assets in MAXIMO w/ PM	Notes
2	Newark Tunnel Shaft	Valve Lot	No documented inspection	September 2017	0	0	
2	Newark Valve Lot	Valve Lot	October 2010	October 2017	6	5	
2	Paseo Padre Shutoff Station	Valve Lot	September 2010	September 2017	5	0	
2	Polhemus Valve Lot	Valve Lot	March 2011	August 2017	10	4	
2	Ravenswood Tunnel Shaft	Valve Lot	No documented inspection	October 2017	0	0	
2	Ravenswood Valve Lot	Valve Lot	August 2010	August 2017	5	5	
2	Redwood City Valve Lot	Valve Lot	October 2010	October 2017	7	4	
2	Tissiack Valve Lot	Valve Lot	October 2010	October 2017	5	0	
3	San Mateo Creek Dam No. 1 (Mud Dam No. 1)	Dam	August 2010	August 2017	1	1	
3	San Mateo Creek Dam No. 2 (Mud Dam No. 2)	Dam	August 2010	August 2017	5	3	
3	Casey Quarry	Quarry	August 2010	August 2017	14	6	
3	Skyline Quarry	Quarry	–	Not currently scheduled	4	2	No inspection needed.
3	Castlewood Reservoir	Reservoir	October 2010	October 2017	11	6	
3	Niles Reservoir	Reservoir	No documented inspection	Not currently scheduled	1	1	Plan for demolition.
3	Town of Sunol Distribution System	Town of Sunol	June 2016	June 2019	281	28	
3	Crystal Springs/El Cerrito Valve Lot	Valve Lot	May 2011	June 2017	6	0	
3	El Camino Real/Bellview Valve Lot	Valve Lot	May 2011	June 2017	6	5	
3	El Camino Real/Millbrae Yard Valve Lot	Valve Lot	May 2011	June 2017	15	7	

Nonlinear Asset Tier	Asset Name	Asset Class	Completion Date of Last Assessment	Scheduled Date of Next Assessment[23]	Number of Assets in MAXIMO	Number of Assets in MAXIMO w/ PM	Notes
3	Hillsborough Valve Lot	Valve Lot	July 2010	August 2017	28	12	
3	Mission and Palm Avenue Valve Lot	Valve Lot	September 2010	September 2017	4	2	
3	Sneath Lane Valve Lot	Valve Lot	August 2010	August 2017	2	0	
3	Southwest Corner Valve Lot (Stanford Tunnel)	Valve Lot	June 2011	June 2017	0	0	
3	Taylor Field Valve Lot	Valve Lot	May 2009	October 2017	0	0	
3	West Valve House (Stanford Tunnel)	Valve Lot	August 2010	August 2017	0	0	
3	East Bay Wells	Well	May 2009	October 2017	10	1	
TBD	Cherry Valley Dam and Release	Dam	March 2012	5 years following completion of corrective work (about 2023)	TBD	TBD	
TBD	Cherry Valley Dam Spillway	Dam	In progress, January 2019	2022	TBD	TBD	
TBD	Eleanor Dam	Dam	June 2016	2021	TBD	TBD	
TBD	Cherry-Eleanor Tunnel	Tunnel	October 2015	2025	TBD	TBD	
TBD	Cherry-Eleanor Pump Station	Pump Station	March 2016	Dependent on Lake Lloyd Elevation, TBD	TBD	TBD	
TBD	Cherry Power Tunnel	Tunnel	November 2017	2027	TBD	TBD	
TBD	Holm Penstock	Penstock	October 2013	2023	TBD	TBD	
TBD	Lower Cherry Creek Diversion Dam and Aqueduct	Dam and Pipeline	March 2017	2028	TBD	TBD	
TBD	O'Shaughnessy Dam Outlet Work	Dam	June 2009	5 years following completion of corrective work	TBD	TBD	

Nonlinear Asset Tier	Asset Name	Asset Class	Completion Date of Last Assessment	Scheduled Date of Next Assessment[23]	Number of Assets in MAXIMO	Number of Assets in MAXIMO w/ PM	Notes
TBD	O'Shaughnessy Dam Spillway	Dam	In progress, January 2019	2023	TBD	TBD	
TBD	O'Shaughnessy Dam	Dam	N/A	2021-2023	TBD	TBD	
TBD	Canyon Power Tunnel	Tunnel	November 2009	2029	TBD	TBD	
TBD	Kirkwood Penstock	Penstock	November 2014	2024	TBD	TBD	Continuous monitoring program to track movement. Kirkwood Generator Bypass – If conditions allow, will inspect after 10 days of continuous operation.
TBD	Early Intake Bypass (tunnel and pipeline)	Tunnel and Pipeline	N/A	2023	TBD	TBD	
TBD	Early Intake Dam	Dam	March 2014	Actively monitoring status. 5 years following completion of corrective work	TBD	TBD	
TBD	Mountain Tunnel	Tunnel	January 2017	20 years following completion of corrective work	TBD	TBD	
TBD	Priest Reservoir	Dam	December 2010	TBD	TBD	TBD	
TBD	Priest Dam	Dam	September 1990	2022	TBD	TBD	
TBD	Priest Bypass	Pipeline	N/A	TBD	TBD	TBD	
TBD	Moccasin Power Tunnel	Tunnel	N/A	TBD	TBD	TBD	
TBD	Moccasin Penstock	Penstock	October 2011	TBD	TBD	TBD	
TBD	Moccasin Dam	Dam	March 2018	TBD	TBD	TBD	
TBD	Moccasin Reservoir	Reservoir	December 2010	2023-2024	TBD	TBD	

Nonlinear Asset Tier	Asset Name	Asset Class	Completion Date of Last Assessment	Scheduled Date of Next Assessment[23]	Number of Assets in MAXIMO	Number of Assets in MAXIMO w/ PM	Notes
TBD	Moccasin Creek Bypass	Pipeline	March 2018	TBD	TBD	TBD	Moccasin Generator Bypasses – If conditions allow, will inspect after 10 days of continuous operation.
TBD	Foothill Tunnel	Tunnel	January 2008	TBD	TBD	TBD	
TBD	SJPLs	Pipeline	2017	Various	TBD	TBD	
TBD	Tesla Valvehouse	Valvehouse	N/A	TBD	TBD	TBD	
TBD	CRT	Tunnel	April 2015	TBD	TBD	TBD	
TBD	Moccasin Compound	Buildings and Grounds	August 2011	TBD	TBD	TBD	

Notes:

AEP = Alameda East Portal
AWP = Alameda West Portal
CSPS = Crystal Springs Pump Station
DSOD = Division of Safety of Dams
EBMUD = East Bay Municipal Utility District
HTWTP = Harry Tracy Water Treatment Plant
N/A = not applicable
PM = preventive maintenance
SAPS = San Antonio Pump Station
SJPL = San Joaquin Pipeline
SVCF = Sunol Valley Chloramination Facility
SCVWD = Santa Clara Valley Water District
SVWTP = Sunol Valley Water Treatment Plant
TBD = to be determined
TTF = Tesla Treatment Facility
WSIP = Water System Improvement Program
UCSR = Upper Crystal Springs Reservoir

Table C-2: WSTD 20-Year Pipeline Inspection Schedule (See Appendix E for Pipeline Inspection Priority Scoring and Techniques)

									INSPECTION PRIORITY SCORE							
									0.375	0.15	0.15	0.15	0.05	0.05	0.075	1.00
Pipeline	**Section**	**Date Last Inspection**	**Date Next Inspection**	**Miles**	**Type**	**Matl.**	**Year Built**	**Dia.**	**Matl.**	**Pop. Density**	**Age**	**Dia.**	**Pipeline PSI**	**Pipeline=5 Adit=4 Tunnel=1**	**Redun-dancy**	**SCORE TOTAL**
San Andreas Pipeline 1	P10 to Baden	11/1/2017 (partial)	11/26/2018	4.41	Pipeline	Steel	1898	44	2	5	5	0.7	2.9	5	1	**28.25**
San Andreas Pipeline 2	R20 to R50		1/1/2019	1.15	Pipeline	Lock-bar / Steel	1927-1928	54	2	5	4	1.6	5	5	1	**29.15**
San Andreas Pipeline 2	R60 to CDD		1/1/2019	1.70	Pipeline	Lock-bar / Steel	1927-1928	54	2	5	4	1.6	3.7	5	1	**28.50**
Bay Division Pipeline 3	C30 to C40		4/1/2019	8.19	Pipeline	Steel	1952	72-78	1	5	3.2	3.5	3.6	5	1	**26.35**
Bay Division Pipeline 2	B60 to B70		4/1/2019	3.97	Pipeline	Steel	1935	66	1	5	3.8	2.5	3.9	5	1	**25.90**
Bay Division Pipeline 4	D30 to D40	6/1/1996	7/1/2019	8.19	Pipeline	Steel	1965-1973	84-96	1	5	2.7	5	3.7	5	1	
Bay Division Pipeline 3	C50 to C70		7/1/2019	7.84	Pipeline	RCP	1952	72-78	1	5	3.2	3.5	3	5	1	**26.05**
Hillsborough Tunnel & Sunset Supply Pipeline	M20 to M30		10/1/2019	2.35	Tunnel / Pipeline	Steel	1955-1958	78-90	1	5	3.1	3.5	2.5	5	1	**25.65**
Balancing Reservoir Pipeline	All	10/1/2005	10/1/2019	0.21	Pipeline	PCCP	1975	96	5	1	2.4	5	0.1	5	1	
San Andreas Pipeline 2	R12 to R20		1/1/2020	2.17	Pipeline	Lock-bar / Steel	1927-1928	54	2	5	4	1.6	5	5	1	**29.15**
Crystal Springs Pipeline 2	K50 to K60		1/1/2020	2.54	Pipeline	Steel	1937	60	1	5	3.7	2	3	5	1	**24.55**
Palo Alto Pipeline	F6 to F60		4/1/2020	5.36	Pipeline	Steel	1938	36	1	5	3.7	0.1	3.6	5	5	**25.00**
Stanford Tunnel	C40 & D40 to C50 & D50		4/1/2020	0.33	Tunnel	Steel	1952	90	1	3	3.2	4.6		1	5	**24.20**
Bay Division Pipeline 1	A60 to A70	10/1/2001	7/1/2020	3.97	Pipeline	Steel	1933	60	2	5	3.8	2	3.9	5	1	
Sunset Supply Pipeline	M30 to M40		10/1/2020	3.62	Pipeline	Steel	1954-1958	60	1	5	3.1	2	2.9	5	1	**23.60**
Crystal Springs Bypass Tunnel (Inspect Every 10 Years)	G20 to G32 & G34	1/1/2011	1/1/2021	3.12	Tunnel	Steel	1970	114	1	4	2.6	5		1	5	
Sunset Supply Pipeline	M60 to CDD		7/1/2021	1.95	Pipeline	Steel	1954-1958	60	1	5	3.1	2	2.7	5	1	**23.50**
Sunset Supply Pipeline	M50 to M60	11/1/1999	10/1/2021	3.41	Pipeline	Steel	1954-1958	60	1	5	3.1	2	2.6	5	1	
Crystal Springs Pipeline 2	K60 to CDD	8/1/2002	1/1/2022	3.68	Pipeline	Steel	1937/1956	60	1	5	3.7	2	3	5	1	
Bay Division Pipeline 4	D10 to D20	1/1/2013	4/1/2022	8.52	Pipeline	PCCP	1967	96	5	5	2.7	5	4	5	1	
San Andreas Pipeline 3	T11 to T50		7/1/2022	3.17	Pipeline	Steel	1994	54-60	1	5	2.2	2	5	5	1	**23.30**
San Andreas Pipeline 3	T50 to T60	3/1/1997	7/1/2022	3.38	Pipeline	Steel	1997	54-60	1	5	2.2	2	4.9	5	1	

									INSPECTION PRIORITY SCORE							
									0.375	0.15	0.15	0.15	0.05	0.05	0.075	1.00
Pipeline	Section	Date Last Inspection	Date Next Inspection	Miles	Type	Matl.	Year Built	Dia.	Matl.	Pop. Density	Age	Dia.	Pipeline PSI	Pipeline=5 Adit=4 Tunnel=1	Redun-dancy	SCORE TOTAL
Pulgas Tunnel	Water Temple to A70, B70, C70, D68 and E70		10/1/2024	2.24	Tunnel	Steel	1967	123	1	2	2.7	5		1	5	**22.55**
Alameda Siphon 2	X10 to X15	2/1/2003	1/1/2023	0.55	Siphon	Steel	1953	90	1	1	3.1	4.5	0.5	5	1	
Sunset Supply Pipeline	M10 to M20		1/1/2023	1.35	Pipeline	Steel	1954-1958	78-90	1	2	3.1	4.5	1.5	5	1	**22.15**
San Andreas Raw Water Pipeline 2	N25 to R12	5/1/1994	10/1/2023	0.16	Adit	Steel	2010	72	1	5	1.2	3		4	1	
San Andreas Raw Water Pipeline 3	N35 to N51	5/1/1994	10/1/2023	0.58	Adit	Steel	2010	72	1	5	1.2	3		4	1	
Crystal Springs Pipeline 1	J60 to CDD		1/1/2024	3.86	Pipeline	Steel	1956	44	1	4	3	0.7	3	5	1	**20.05**
Calaveras Pipeline	V34 to SVWTP		4/1/2024	3.96	Pipeline	Steel	1992	44	1	1	1.8	0.7	4.3	5	1	**14.40**
San Mateo Creek Dam Pipeline and Tunnel 2	All	9/1/2009	7/1/2024	1.61	Tunnel / Pipeline	Steel	1937	48	1	1	3.7	1.1		1	1	
San Antonio Reservoir Pipeline Adit	V27 to Y20		7/1/2024	0.27	Adit	Steel	1967	42	1	1	2.7	0.6		4	1	**12.95**
Crystal Springs Outlet Tunnel 1	H12 to H87	7/1/2005	7/1/2025	0.10	Outlet Tunnel	Steel	1891	44	1	1	5	0.7		4	1	
Crystal Springs Outlet Tunnel 2	H23 to H82	7/1/2005	7/1/2025	0.13	Outlet Tunnel	Steel	1931	54	1	1	3.9	1.6		4	1	
Bay Division Pipeline 4	D50 to D68	5/19/2017	1/1/2026	7.86	Pipeline	PCCP	1967	84-96	5	5	2.7	5	3	5	1	
San Antonio Pipeline	W20 to Y20	8/4/2016	1/1/2026	2.07	Pipeline	PCCP	1967	60	5	1	2.7	2	0.9	5	1	
Alameda Siphon 3	X20 to X22 and X25	10/13/2016	1/1/2026	0.55	Siphon	PCCP	1967	96	5	1	2.7	5	0.5	5	1	
Balancing Reservoir Pipeline	All		1/1/2026	0.21	Pipeline	PCCP	1975	96	5	1	2.4	5	0.1	5	1	
Crystal Springs Pipeline 2	K20 to K40	12/1/2006	1/1/2027	5.30	Pipeline	Steel	1937	54-60	1	5	3.7	2	2.9	5	1	
Bay Division Pipeline 3	C10 to C20	3/1/2007	4/1/2027	8.55	Pipeline	RCP	1952	72-78	1	5	3.2	3.5	4	5	1	
Sunset Supply Pipeline	M40 to M50	11/1/2007	7/1/2027	3.66	Pipeline	Steel	1954-1958	60	1	5	3.1	2	2.8	5	1	
Crystal Springs Pipeline 3	L30 to L41K	11/16/2017	10/1/2027	3.61	Pipeline	PCCP	1971	60	5	5	2.5	2	2.9	5	1	
Crystal Springs Pipeline 3	P48 to L59K	11/16/2017	10/1/2027	2.54	Pipeline	PCCP	1987	60	5	5	2	2	2.9	5	1	
Bay Division Pipeline 1	A50U to A60	3/1/2009	1/1/2028	4.92	Pipeline	Steel	1933	60	1	5	3.8	2	4.1	5	1	
Crystal Springs Bypass Pipeline	G34 to G41	6/28/2018	4/1/2028	0.81	Pipeline	PCCP	1970	96	5	2	2.6	5	1.5	5	1	
Bay Division Pipeline 4	D20 to D30	12/1/2009	1/1/2029	8.96	Pipeline	Steel	1965-1973	84-96	1	5	2.7	5	4.1	5	1	
Bay Division Pipeline 3	C20 to C30	3/1/2010	10/1/2029	8.96	Pipeline	Steel	1952	72-78	1	5	3.2	3.5	4.1	5	1	
San Andreas Pipeline 2	R50 to R60	6/1/2010	1/1/2030	3.38	Pipeline	Lock-bar / Steel	1927-1928	54	2	5	4	1.6	4.9	5	1	
Alameda Siphon 1	X30 to X35	10/1/2010	1/1/2030	0.56	Siphon	RCP	1933	69	1	1	3.8	2.8	0.5	5	1	

									INSPECTION PRIORITY SCORE							
									0.375	0.15	0.15	0.15	0.05	0.05	0.075	1.00
Pipeline	Section	Date Last Inspection	Date Next Inspection	Miles	Type	Matl.	Year Built	Dia.	Matl.	Pop. Density	Age	Dia.	Pipeline PSI	Pipeline=5 Adit=4 Tunnel=1	Redun-dancy	SCORE TOTAL
Bay Division Pipeline 2	A10 to A20	10/1/2010	4/1/2030	7.12	Pipeline	RCP & Steel	1935	66	1	5	3.8	2.5	4.1	5	1	
Bay Division Pipeline 1	B10 to B20	3/1/2011 & 8/1/2015	4/1/2030	7.11	Pipeline	RCP & Steel	1933	60	2	5	3.8	2	4.1	5	1	
Bay Division Pipeline 4	D10 to D20		7/1/2030	8.52	Pipeline	PCCP	1967	96	5	5	2.7	5	4	5	1	
Crystal Springs Bypass Tunnel (Inspect Every 10 Years)	G20 to G32 & G34	1/1/2011	10/1/2030	3.12	Tunnel	Steel	1970	114	1	4	2.6	5		1	5	
New Crystal Springs Bypass Tunnel	G32 to G36		10/1/2030	0.80	Tunnel	Steel	2012	96	1	2	1.1	5	1.5	1	1	
Alameda Siphon 4	All		7/1/2031	0.54	Siphon	Steel	2013	66	1	1	1.1	2.5	0.5	5	1	
San Andreas Pipeline 3	T60 to CDD		7/1/2031	1.94	Pipeline	Steel	2012	36	1	5	1.1	0.1	3.7	5	1	
Bay Division Pipeline 5	E60 to E70		10/1/2031	4.00	Pipeline	Steel	2013	60	1	5	1.1	2	3.9	5	1	
Bay Division Pipeline 5	E50U to Redwood City Valve Lot		1/1/2032	4.93	Pipeline	Steel	2013	60	1	5	1.1	2	4.1	5	1	
Bay Division Pipeline 5	New Irvington Tunnel to Newark Valve Lot		4/1/2032	7.01	Pipeline	Steel	2013	72	1	5	1.1	3	4.1	5	1	
San Antonio Backup Pipeline	All		7/1/2032	1.32	Pipeline	Steel	2013	66	1	1	1	2.5	0.4	5	1	
Sunset Branch	N42 to M41	10/1/2013	10/1/2032	1.11	Pipeline	Steel	1954	61	1	5	3.1	2.1	2.7	5	1	
Crystal Springs Pipeline 2	K10 to K20	5/21/2014	7/1/2033	2.36	Pipeline	Steel	1937	54-60	1	3	3.7	2	2.3	5	1	
Crystal Springs San Andreas Force Main	H83 to San Andreas		10/1/2033	4.50	Force Main	Steel	2015	60	1	2	1	2		5	1	
Irvington Tunnel 2	All		10/1/2034	3.59	Tunnel	Steel	2015	102	1	2	1	5		1	1	
Irvington Tunnel 1	All	4/4/2015	4/1/2034	3.48	Tunnel	Steel	1933	126	1	2	3.8	5		1	1	
Bay Division Pipeline 2	B50U to B60	7/1/2015	7/1/2034	4.92	Pipeline	Steel	1935	66	1	5	3.8	2.5	4.1	5	1	
Sunol Valley Water Treatment Plant 78" Effluent Pipeline	All	9/1/2015	10/1/2034	1.59	Pipeline	Steel	1966	78	1	1	2.7	3.5	0.7	5	1	
Calaveras Pipeline	SVWTP to W10	9/1/2015	10/1/2034	1.63	Pipeline	Steel	1966	66	2	1	2.7	2.5		5	1	
Bay Division Pipeline 4	D50 to D68		1/1/2035	7.86	Pipeline	PCCP	1967	84-96	5	5	2.7	5	3	5	1	
San Antonio Pipeline	W20 to Y20		1/1/2035	2.07	Pipeline	PCCP	1967	60	5	1	2.7	2	0.9	5	1	
Alameda Siphon 3	X20 to X22 and X25		1/1/2035	0.55	Siphon	PCCP	1967	96	5	1	2.7	5	0.5	5	1	
Balancing Reservoir Pipeline	All		1/1/2035	0.21	Pipeline	PCCP	1975	96	5	1	2.4	5	0.1	5	1	
Pilarcitos Tunnel 1	S10 to S13	7/7/2016	4/1/2036	0.29	Tunnel	Brick	1868	3'6" x 5'1"	2	1	5	5		1	1	
Crystal Springs Pipeline 2	K40 to K50	10/12/2016	7/1/2036	3.86	Pipeline	Steel	1937	54-60	1	5	3.7	2	2.9	5	1	
Bay Tunnel	E20U to E50U, B50U and A50U	11/16/2016	10/1/2036	5.14	Tunnel	Steel	2015	108	1	1	1	5		1	5	

									INSPECTION PRIORITY SCORE							
									0.375	0.15	0.15	0.15	0.05	0.05	0.075	1.00
Pipeline	Section	Date Last Inspection	Date Next Inspection	Miles	Type	Matl.	Year Built	Dia.	Matl.	Pop. Density	Age	Dia.	Pipeline PSI	Pipeline=5 Adit=4 Tunnel=1	Redun-dancy	SCORE TOTAL
Calaveras Outlet Pipe	Outlet Tower to V34	5/9/2017	1/1/2037	0.28	Adit	Steel	2016	72-78	1	1	1	3		4	1	
Upper Alameda Creek Tunnel	Upper Alameda Creek to Calaveras Reservoir	1/16/2018	1/1/2037	1.85	Tunnel	Concrete	1931	5'6" x 6'6'"	1	1	3.9	5		1	1	
Crystal Springs Pipeline 3	L30 to L41K	11/16/2017	4/1/2037	3.61	Pipeline	PCCP	1971	60	5	5	2.5	2	2.9	5	1	
Crystal Springs Pipeline 3	P48 to L59K	11/16/2017	4/1/2037	2.54	Pipeline	PCCP	1987	60	5	5	2	2	2.9	5	1	
Crystal Springs Bypass Pipeline	G34 to G41		7/1/2037	0.81	Pipeline	PCCP	1970	96	5	2	2.6	5	1.5	5	1	
Bay Division Pipeline 3 & 4 Crossover Pipelines	I-680	5/30/2018	7/1/2037	0.41	Pipeline	Steel	2014	78	1	5	1.1	3.5	2.5	5	1	

Notes:
BDPL = Bay Division Pipeline
CDD = City Distribution Division
CSPL = Crystal Springs Pipeline
NIT = New Irvington Tunnel
PCCP = prestressed concrete cylinder pipe
RCP = reinforced concrete cylinder pipe
SABPL = San Antonio Backup Pipeline
SAPL = San Andreas Pipeline
SSPL = Sunset Supply Pipeline
SVWTP = Sunol Valley Water Treatment Plant
WSTD = Water Supply and Treatment Division

Table C-3: Existing HHWP Facility Condition Assessment Information

Facility	Condition Assessment Reports (2007-present)
Cherry Valley Dam and Release	Cherry Delivery Improvements Evaluation Report, CH2M Hill, 2012
Eleanor Dam	ELDM Needs Assessment Report, MWH, June 2016
	ELDM Needs Assessment Inspection Report, MWH, April 2016
Cherry-Eleanor Tunnel	Cherry Delivery Improvements Evaluation Report, CH2M Hill
Cherry-Eleanor Pump Station	Cherry Delivery Improvements Evaluation Report, CH2M Hill
	Cherry Pump Station FINAL AAR Alternative Analysis Report, EMB, 2016
Cherry Power Tunnel	N/A
Holm Penstock	HPH Penstock Condition Assessment by CH2M Hill, 2012
Holm Powerhouse	HPH Technical Memorandum, 2010
Lower Cherry Creek Diversion Dam and Aqueduct	Cherry Delivery Improvements Evaluation Report, CH2M Hill, 2012
O'Shaughnessy Dam and Discharge	Draft – O'Shaughnessy Outlet Works Study, B&V, 2009
	Draft O'Shaughnessy Outlet Works Investigation, B&V
	O'Shaughnessy Drum Gates Condition Assessment Report, 2008
	O'Shaughnessy Discharge Facilities Risk Assessment, 2011
	O'Shaughnessy Outlet Works Rehabilitation Project Planning Report, 2015
Canyon Power Tunnel	Canyon Power Tunnel Inspection Report, 2009
	HH Adit January 2009 Repairs Report CDM and Jacobs Associates
Kirkwood Penstock	Final two analyses KPH Geo-Structural Assessment and Revised Executive Summary, 2010
	KPH Penstock Geo-Structural Assessment, B&V, 2009
	KPH Penstock Risk Analysis, B&V, 2014
	KPH Penstock Inspection Report Final, B&V, 2014
	Kirkwood Risk Reduction – EN-11 Inspection Report (Final 031816), B&V, 2016
Kirkwood Powerhouse	KPH Technical Memorandum, 2010
Kirkwood Bypass Tunnel	Kirkwood Bypass Tunnel Inspection Report, March 2017
Early Intake Bypass Pipeline	N/A
Early Intake Dam	Condition Assessment of Early Intake Dam, 2014

Facility	Condition Assessment Reports (2007-present)
Early Intake Diversion Dam	CS-943 Task Order 18 Condition Assessment, February 2014
Mitchell Ravine	Draft Conceptual Design Stabilization Measures, Mitchell Ravine, CH2M Hill, 2009
Mountain Tunnel	2008 Condition Assessment of Mountain Tunnel
	Mountain Tunnel Alternatives Analysis, Report, URS, 2013
Priest Dam and Reservoir	Water Quality and Security Improvements Plan for Moccasin and Priest Reservoirs – Assess Condition of Existing Moccasin Reservoir Facilities, 2010
Priest Bypass	N/A
Moccasin Power Tunnel	N/A
Moccasin Penstock	Moccasin Penstock Condition Assessment Report, 2005
	Moccasin Penstock Phase 1 Condition Assessment Report, CH2M Hill, 2011
	Moccasin Penstock Surge Study, 2013
Moccasin Powerhouse	MPH Condition Assessment Report, B&V, 2009
Moccasin Dam and Reservoir	Water Quality and Security Improvements Plan for Moccasin and Priest Reservoirs – Assess Condition of Existing Moccasin Reservoir Facilities, 2010
Moccasin Creek Bypass	Inspection Report, 2010
	Inspection Report, Jared Dunn & Romeo Rombawa, 2008
Moccasin Lowhead Powerhouse	MLH Technical Memorandum, 2009
Foothill Tunnel	JA RPT 01 Volume 1 of 1, 2008
	JA RPT 01 Volume 2 of 2, 2008
	Don Pedro Crossing-Red Mountain Bar W Impact Analysis, URS, 2014
SJPL	SJPL No. 1 Interim Inspection Report, 2008
	Inspection Plan and Summary, Emtek, 2009
	SJPL No. 1 Internal Inspection, Emtek, 2010
	ACE 10 ILI Paper
	Draft – SJPL Report, CH2M Hill, 2014
	SJPL Condition Assessment at McHenry Avenue, CH2M Hill, 2015
	SJPL No. 3 MP49.84 to 56.31, Openaka, 2009
	Roselle Internal Ins Report MFL In-Line, 2010, Emtek

Facility	Condition Assessment Reports (2007-present)
	Roselle Xover ILI MP69.74 to 85.48, CH2M Hill, 2011
	SJPL High Phase Water Discharge
	DRAFT SJPL NAR Compiled 20151022, MWH, 2015
	SJPL System Entry Assessment AAR, MWH, 2016
	SJPL No. 3 Condition Assessment at Tesla Portal, CH2M Hill, 2016
	SJPL No. 1 Inspection from Emery to Tesla, 2017
Tesla Valvehouse	N/A
CRT	Condition Assessment, 2015

Other	Condition Assessment Reports (2007-present)
Power Summary	Final_HH_Power Assets Master Plan, 2009
Transmission Lines	Report Power Delivery Facilities Condition Assessment, 2009
	Final Trans Line Clearance Mitigation, B&V, 2014
	Trans Line Clearance Evaluation, B&V, June 2013
	DRAFT Trans Line Clearance Mitigation, B&V
Roads and Bridges	Inspection Report – Cherry Lake Road Bridge at Intake, 2013
	Draft Hydraulic Report, URS, 2013
	Bridge Design and Performance Criteria, URS, 2013
	OID Bridge – East of WSY, 2013
	Turkey Ranch Road Bridge Inspection Report, URS, 2013
	Summary and Cost Opinion Report, Draft Final, URS, 2013
	South Fork Siphon Access Bridge-Seismic Analysis, URS, 2013
	South Fork Siphon Access Bridge Inspection Report, URS, 2013
	South Fork Siphon Access Bridge-Hydraulic Analysis, URS, 2013
	Roadways – Draft Performance Criteria, URS, 2013
	Roadways – Draft Condition Assessment, URS, 2013
	O'Shaughnessy Adit Access Bridge – Seismic Analysis, URS, 2013
	O'Shaughnessy Adit Access Bridge – Inspection Report, URS, 2013
	O'Shaughnessy Adit Access Bridge – Hydraulic Analysis, URS, 2013

Other	Condition Assessment Reports (2007-present)
	Moccasin Debris Deflector Bridge – Hydraulic Analysis, URS, 2013
	Moccasin Debris Deflector Bridge – Seismic Analysis, URS, 2013
	CA Aqueduct Bridge 1-Inspection Report-, URS, 2013
	CA Aqueduct Bridge 2-Inspection Report-, URS, 2013
	Cherry Lake Road Bridge Over Cherry Creek – Hydraulic Analysis Report-, URS, 2013
	Cherry Lake Road Bridge Over Cherry Creek – Inspection Report-, URS, 2013
	Cherry Lake Road Bridge Over Cherry Creek – Seismic Analysis Report-, URS, 2013
	Cherry Lake Road Bridge Over Middle Fork – Hydraulic Analysis Report-, URS, 2013
	Cherry Lake Road Bridge Over Middle Fork – Inspection Report-, URS, 2013
	Cherry Lake Road Bridge Over Middle Fork – Seismic Analysis Report-, URS, 2013
	Early Intake Bridge – Hydraulic Analysis Report-, URS, 2013
	Early Intake Bridge – Inspection Report-, URS, 2013
	Early Intake Bridge – Seismic Analysis Report-, URS, 2013
	Holm Intake Access Bridge – Hydraulic Analysis Report-, URS, 2013
	Holm Intake Access Bridge – Seismic Analysis Report-, URS, 2013
	Holm Intake Access Road Bridge – Inspection Report-, URS, 2013
	Moccasin Debris Deflector Bridge – Inspection Report-, URS, 2013
Moccasin Wastewater	CDM RPT, 2011 – Technical Memorandum
Moccasin Compound	Draft Server Room Cond Assessment Report, 2011
	Moccasin Facilities Upgrade Project Alternatives, 2012
	Moccasin Space Planning and Facilities Master Plan, 2009
Discharge Points	Draft HHWP Point of Discharge Review, 2014

Notes:
AAR = Alternatives Analysis Report
B&V = Black & Veatch
HHWP = Hetch Hetchy Water and Power
N/A = not applicable
SJPL = San Joaquin Pipeline

Table C-4: Dam Monitoring Program Activities

Dam	Dam Displacement Survey and Inspection Dates in FY17 and FY18	DSOD Annual Dam Inspection Dates in FY17 and FY18	Summary of Valve Movements in FY17 and FY18	Summary of Vegetation Management for FY17 and FY18	Dam Repair Tasks in FY17 and FY18 and Planned for FY19 and FY 20
O'Shaughnessy	• Weekly Seepage and Inspection • Dam Displacement Surveys: September 21, 2016 June 8, 2017	June 23, 2017 April 23, 2018 The 2016 annual report was filed with the DSOD in December 2017. HHWP and DSOD findings indicate that facilities are safe for continued use.	2017 • Valve 1 exercised on July 11, 2017, and July 12, 2017. • Valve 28 exercised on May 19, 2017. • Valves 12 13 exercised on June 24, 2017. • Valve 15 exercised on September 13, 2016. • Valve 16 exercised on September 13, 2016, and December 8, 2016. • Slide Gates A, B, and C exercised on August 13, 2016, and November 18, 2016. • Slide Gates 9, 10, 11 exercised November 18, 2016. • Slide Gates 12, 13, and 14 exercised on January 3, 2017. • Drum Gates exercised on March 27, 2017. 2018 • Valve 28 exercised on March 21, 2018. • Valve 12 13 in normal operation. • Valve 15 16 exercised on August 22, 2017. • Slide Gates A, B, and C exercised on October 3, 2017, and March 21, 2018. • Slide Gates 9, 10, and 11 exercised on October 3, 2017. • Slide Gates 12, 13, and 14 in operation. • Drum Gates in normal operation.	No activities required.	Spillway maintenance repair (January 2019). New log boom (March 2019).

Dam	Dam Displacement Survey and Inspection Dates in FY17 and FY18	DSOD Annual Dam Inspection Dates in FY17 and FY18	Summary of Valve Movements in FY17 and FY18	Summary of Vegetation Management for FY17 and FY18	Dam Repair Tasks in FY17 and FY18 and Planned for FY19 and FY 20
Cherry	• Weekly Seepage and Inspection • Dam Displacement Surveys: August 10, 2017	June 23, 2017 January 5, 2018 The 2016 annual report was filed with the DSOD in December 2017. HHWP and DSOD findings indicate that facilities are safe for continued use.	2017 Hollow Jet Valves 1 and 2 not exercised. BFVs 1, 2, and 3, along with 12-inch needle, BFV, and 6-inch fish release valve all exercised almost every month. 2018 Hollow Jet Valves 1 and 2 were removed and Fixed Cone Valves 1 and 2 were installed and exercised on April 24, 2018. The 6-inch ball valve was removed. BFVs 1, 2, and 3, along with 12-inch needle, and BFV operated numerous times over their full range in December through February. New Jet Flow Valves 1 and 2 were installed and exercised on April 24, 2018, and May 4, 2018.	Vegetation/tree removal completed March 17, 2017, and October 30, 2017.	Replace seepage weirs (October 2018). New log boom (March 2019).
Lake Eleanor	• Weekly Seepage and Inspection • Dam Displacement Surveys: June 29, 2017	June 23, 2017 April 24, 2018 The 2016 annual reports were filed with the DSOD in December 2017. HHWP and DSOD findings indicate that facilities are safe for continued use.	2017 Valves 1, 2, 3, and 4 operated over full range during runoff, exercised on April 23, 2017, and June 23, 2017. 2018 Valves 1, 2, 3, and 4 operated over full range during runoff, exercised on August 1, 2017, and December 12, 2017.	Vegetation removal completed March 3, 2017.	Spillway maintenance repair and wingwall access (October 2018).
Early Intake	• Weekly Seepage and Inspection • Dam Displacement Surveys: August 11, 2016 April 11, 2018	June 23, 2017 January 5, 2018 The 2016 annual report was filed with the DSOD in December 2017. HHWP and DSOD findings indicate that facilities are safe for continued use.	2017 Gates 1 and 2 and Guard Gates 1 and 2 operated throughout year. Exercised on March 28, 2017, and June 23, 2017. 2018 Gates 1 and 2 and Guard Gates 1 and 2 operated throughout year. Exercised on December 3, 2017, and March 9, 2018.	Vegetation removal completed March 3, 2017, and September 15, 2017.	• Concrete coring to measure concrete strength (2020). • Geologic assessment of left abutment (2020). • Spillway maintenance repairs (December 2018). • Initiate crack mapping and laser scan monitoring program (complete). • Initiate spillway south wall monitoring program (complete).

Dam	Dam Displacement Survey and Inspection Dates in FY17 and FY18	DSOD Annual Dam Inspection Dates in FY17 and FY18	Summary of Valve Movements in FY17 and FY18	Summary of Vegetation Management for FY17 and FY18	Dam Repair Tasks in FY17 and FY18 and Planned for FY19 and FY 20
Priest	• Weekly Seepage and Inspection • Bi-weekly Piezometers • Dam Displacement Surveys: July 7, 2016 February 15, 2017 August 1, 2017 November 1, 2017	May 4, 2017 April 24, 2018 The 2016 annual report was filed with the DSOD in December 2017. HHWP and DSOD findings indicate that facilities are safe for continued use.	2017 • Ball Valve and BFVs 1 and 2 exercised on March 24 and May 4, 2017. • Slide Gates 1 and 2, and Bypass BFV exercised on August 16, 2016, December 6, 2016, and May 23, 2017. 2018 • Ball Valve and BFVs 1 and 2 exercised April 24, 2018. • Slide Gates 1 and 2, and Bypass BFV exercised on August 16, 2017, and January 31, 2018.	• Vegetation removal completed June 26, 2017. • Rodent removal March 9, 2017, and February 5 2018.	
Moccasin	• Weekly Seepage and Inspection • Bi-weekly Piezometers • Dam Displacement Surveys: August 1, 2017 February 8, 2018 March 22, 2018 March 23, 2018 March 26, 2018 May 1, 2018 May 8, 2018	May 4, 2017 April 25, 2018 The 2016 annual report was filed with the DSOD in December 2017 (following inspection of May 4). HHWP and DSOD findings indicate that facilities are safe for continued use. On March 22, 2018, a significant storm event resulted in record high water in Moccasin Reservoir and damage to the facility. As a result, DSOD has issued a requirement that the reservoir shall remain empty until repairs are made to the toe of the dam, the spillway and the fill material is replaced in the top three feet of the dam. Repairs will be completed in 2018, at which time the reservoir will be returned to service.	2017 • Normal operation of Gates 1, 1a, 2, and 2a. • Gate 3 operated on March 8, 2017. 2018 • Normal operation of Gates 1, 1a, 2, and 2a all exercised on February 6, 2018. • Gate 3 operated on March 23, 2018.	• Vegetation removal completed June 26, 2017. • Rodent removal March 9, 2017, and February 5 2018.	

Dam	Dam Displacement Survey and Inspection Dates in FY17 and FY18	DSOD Annual Dam Inspection Dates in FY17 and FY18	Summary of Valve Movements in FY17 and FY18	Summary of Vegetation Management for FY17 and FY18	Dam Repair Tasks in FY17 and FY18 and Planned for FY19 and FY 20
Calaveras	Dam replacement construction started on August 2011; anticipated completio is in 2019.	The dam is monitored under the WSIP dam replacement contract until completion in 2019.	WSIP construction – no activities.	WSIP construction – no activities.	Automation of geo-monitoring points such as piezometers, survey monuments, and inclinometer, after construction is complete.
Turner	• Dam Instrumentation Readings, and Inspection Dates: July 18, 2016 August 23, 2016 September 22, 2016 October 21, 2016 November 10, 2016 December 22.2016 January 27, 2016 February 23, 2017 March 17, 2017 April 21, 2017 May 19, 2017 June 27, 2017 July 18, 2017 August 24, 2017 September 21, 2017 October 25, 2017 November 29, 2017 December 20, 2017 January 29, 2018 February 27, 2018 March 28, 2018 • Displacement Survey: October 17, 2016 June 8, 2017 November 22, 2017	August 25 and September 1, 2016, October 18, 2017. Latest DSOD inspection report shows that the dam, reservoir, and the appurtenances are judged safe for continued use.	• Inlet valves Y02, Y03, Y04, H82 and Y05 (except Y01) were exercised on August 25, 2016. • Emergency release valve Y22, Line valves Y20 and Y21, and Inlet valves Y02, Y03, Y04, H82 and Y05 (except Y01) were exercised on October 18, 2017.	• Tules, bushes approximately 5 feet along groins and toe of dam were removed in September 2017. • Pest control contract to trap gophers finished in September 2017. • Restarted pest control contract in February 2018. It will continue to the end of spring 2018.	• Flush piezometers (November to December 2017). • Fill rodent holes at the edge of the dam crest pavement and railing supports (completed December 2017). • Replace valve actuator in the adit structure bottom adit (ongoing).

Dam	Dam Displacement Survey and Inspection Dates in FY17 and FY18	DSOD Annual Dam Inspection Dates in FY17 and FY18	Summary of Valve Movements in FY17 and FY18	Summary of Vegetation Management for FY17 and FY18	Dam Repair Tasks in FY17 and FY18 and Planned for FY19 and FY 20
Lower Crystal Springs	• Dam Instrumentation Readings, and Inspection Dates: July 14, 2016 August 17, 2016 September 14, 2016 October 19, 2016 November 15, 2016 December 20.2016 January 17, 2017 February 22, 2017 March 23, 2017 April 20, 2017 May 22, 2017 June 21, 2017 July 21, 2017 August 23, 2017 September 20, 2017 October 31, 2017 November 21, 2017 December 19, 2017 January 23, 2018 February 26, 2018 March 23, 2018 • Displacement Survey: October 13, 2016 April 1, 2017 December 15, 2017	• June 22, 2016 • September 14, 2016 • April 30, 2018 DSOD inspection report shows that the dam, reservoir, and the appurtenances are judged safe for continued use.	Emergency release valves H91 and H92, and line valves H81 and H87 were exercised on March 21, 2018.	No vegetation removal during this period due to fall hazards created by the San Mateo Bridge construction.	• Add riprap around emergency dissipation structure (design completed; construction is anticipated for summer 2018). • Toe Piezometer Retrofit (design completed; construction is anticipated for summer 2018). • Decommissioning of old outlet pipe (design completed; construction is anticipated for summer 2018). • Add security fence and gate resulting from new San Mateo Bridge (ongoing).

Dam	Dam Displacement Survey and Inspection Dates in FY17 and FY18	DSOD Annual Dam Inspection Dates in FY17 and FY18	Summary of Valve Movements in FY17 and FY18	Summary of Vegetation Management for FY17 and FY18	Dam Repair Tasks in FY17 and FY18 and Planned for FY19 and FY 20
San Andreas	• Dam Instrumentation Readings, and Inspection Dates: July 21, 2016 August 18, 2016 September 19, 2016 October 18, 2016 November 9, 2016 December 19.2016 January 26, 2016 February 27, 2017 March 16, 2017 April 18, 2017 May 17, 2017 June 23, 2017 July 19, 2017 August 18, 2017 September 19, 2017 October 20, 2017 November 20, 2017 December 15, 2017 January 24, 2018 February 20, 2018 March 26, 2018 • Displacement Survey: October 12, 2016 August 17, 2017 December 19, 2017	March 6, 2017 September 7, 2017 DSOD inspection report shows that the dam, reservoir, and the appurtenances are judged safe for continued use.	• The DSOD acknowledges that the SFPUC has a plan to add blowoff valves on SAPL No. 2 and SAPL No. 3 raw water lines in HTWTP that will satisfy the DSOD's draw down criteria. • The inlet valves are operated regularly as part of the Harry Tracy Treatment Plant operation.	• Controlled burn on the face of the dam completed in July 2016 and August 2017. • Pest Control has been ongoing. • Removal of trees along the spillway chute is planned for summer 2018.	• Repair of piezometers #12 and #19 casing is needed again at San Andreas Dam after the log boom was knocked off the piezometer casings. Piezometer #20 also needs repair (ongoing). • Install riprap for erosion protection at the outlet of the stilling basin (completed August 2017). • Upgrade of open well piezometers. • Repair of small cracks on the spillway (summer 2018).

Dam	Dam Displacement Survey and Inspection Dates in FY17 and FY18	DSOD Annual Dam Inspection Dates in FY17 and FY18	Summary of Valve Movements in FY17 and FY18	Summary of Vegetation Management for FY17 and FY18	Dam Repair Tasks in FY17 and FY18 and Planned for FY19 and FY 20
Pilarcitos	• Dam Instrumentation Readings, and Inspection Dates: July 22, 2016 August 19, 2016 September 15, 2016 October 20, 2016 November 14, 2016 December 21.2016 January 25, 20167 February 28, 2017 March 20, 2017 April 19, 2017 May 18, 2017 June 22, 2017 July 20, 2017 August 21, 2017 September 22, 2017 October 24, 2017 November 22, 2017 December 18, 2017 January 26, 2018 February 21, 2018 March 27, 2018 • Displacement Survey: October 12, 2016 August 14, 2017 November 27, 2017	March 6, 2017 September 7, 2017 The DSOD inspection report shows that the dam, reservoir, and the appurtenances are judged safe for continued use pending the seismic stability of the outlet tower.	S10 was operated monthly from March 2017 to June 2017, and from August 2017 to September 2017.	• Control burn on the face of the dam was completed in July 2016 and August 2017. • Removal of trees along the spillway chute is planned for summer 2018.	(None)
San Mateo Creek Dam No. 1				Various vegetation removal activities have recently been completed on San Mateo Creek Dam No. 1 (also referred to as Mud Dam) to improve its structural integrity.	

Dam	Dam Displacement Survey and Inspection Dates in FY17 and FY18	DSOD Annual Dam Inspection Dates in FY17 and FY18	Summary of Valve Movements in FY17 and FY18	Summary of Vegetation Management for FY17 and FY18	Dam Repair Tasks in FY17 and FY18 and Planned for FY19 and FY 20
Sunset Reservoir North Basin	2017 Instrumentation report submitted April 18, 2017. Monument survey readings indicated no significant changes in settlement or horizontal alignment. Piezometers indicated low phreatic surface and no annual trends. Underdrains show variation within normal limits.	• January 8, 2016 • February 28, 2017 • March 6, 2018 Conclusions from the March 6, 2018, inspection indicate that, based on the known information and visual inspection, the dam, reservoir, and appurtenances are judged safe for continued use.	2017 • 12-inch drain valve was partially cycled during inspection on February 28, 2017. 2018 • 12-inch drain valve was fully cycled during inspection on March 6, 2018.	[pending data compilation]	[pending data compilation]
Sunset Reservoir South Basin	2017 Instrumentation report submitted April 18, 2017. Monument surveys indicated no unusual readings or significant changes in settlement or horizontal alignment.	• January 8, 2016 • February 28, 2017 • March 6, 2018 Conclusions from the March 6, 2018, inspection indicate that, based on the known information and visual inspection, the dam, reservoir, and appurtenances are judged safe for continued use.	2016 • 16-inch gate valve that controls reservoir drain was exercised on January 8, 2016.	[pending data compilation]	[pending data compilation]
University Mound Reservoir North Basin	2017 Instrumentation report submitted on April 18, 2017. Monument surveys indicated no unusual readings or significant changes in settlement or horizontal alignment; readings follow historical trends. Piezometer readings were relatively constant throughout the year and show no anomalous trends; piezometer readings were normal. Underdrains were dry, which is normal.	• February 9, 2016 • February 28, 2017 • March 7, 2018 Conclusions from the March 7, 2018, inspection indicate that, based on the known information and visual inspection, the dam, reservoir, and appurtenances are judged safe for continued use.	2017 [pending review of 2017 inspection report] 2018 • 12-inch drain valve was fully cycled during inspection on March 7, 2018	[pending data compilation]	[pending data compilation]

Dam	Dam Displacement Survey and Inspection Dates in FY17 and FY18	DSOD Annual Dam Inspection Dates in FY17 and FY18	Summary of Valve Movements in FY17 and FY18	Summary of Vegetation Management for FY17 and FY18	Dam Repair Tasks in FY17 and FY18 and Planned for FY19 and FY 20
University Mound Reservoir South Basin	2017 Instrumentation report submitted on April 18, 2017. Monument surveys indicated some movement in two survey points and no significant changes in the annual settlements or horizontal alignments in the remaining monuments. Underdrains indicated normal ranges in flow. Overall, the DSOD report indicated that instrumentation reflects satisfactory performance of the dam.	• February 9, 2016 • February 28, 2017 • March 7, 2018 Conclusions from the March 7, 2018, inspection indicate that, based on the known information and visual inspection, the dam, reservoir, and appurtenances are judged safe for continued use.	2016 12-inch drain valve was partially exercised on February 9, 2016. 2018 12-inch drain valve was fully cycled during inspection on March 7, 2018.	[pending data compilation]	[pending data compilation]
Merced Manor Reservoir	[pending data compilation]	(Merced Manor is not a DSOD jurisdictional dam)	[pending data compilation]	[pending data compilation]	[pending data compilation]

Notes:
BFV = butterfly valve
DSOD = Division of Safety of Dams
FY = fiscal year
HHWP = Hetch Hetchy Water and Power
WSIP = Water System Improvement Program

Appendix D: Condition Assessment Tables

Table D-1: WSTD Inventory and Condition of Active Pipelines and Tunnels

Bay Area:

Pipeline	Structural Material	Coating	Lining	Leak History	Rehabilitation or Relocation
San Antonio	PCCP	Cement	Concrete	Leaks caused by seismic ground movement along the Calaveras fault have occurred in 1998, 2003, 2014, and 2017.	Approximately 300 feet of pipe were replaced with WSP for joint separation from the Calaveras Fault (1998); three pipe segments were replaced with WSP to repair damage from pipe burst (2003); two segments were repaired with WEKO-SEAL in 2014. Internal butt strap repair was made at the joint (2017).
Calaveras	WSP	Cement	Cement	No documented leaks.	The original 1924 pipeline was reconstructed from Calaveras Dam to SVWTP in 1992.
Alameda Siphon No. 1	RCP	Cement	Concrete	No documented leaks.	Valve X32 was installed to back up valve X30 in 2005.
Alameda Siphon No. 2	WSP	Coal tar	Coal tar	No documented leaks.	Valve X14 was installed to regulate flow from SVWTP and CRT in 2000. Valve X10 was replaced in 2010.
Alameda Siphon No. 3	PCCP	Cement	Concrete	No documented leaks.	Valve X24 was installed to back up valve X25 in 2003; valve X20 was replaced in 2001.
Alameda Siphon No. 4	WSP	Cement	Polyurethane	New pipe.	No pipeline modifications or alignments.
SVWTP 78-Inch Treated Water	WSP	Coal tar	Cement	Pipe failure caused by axial compression due to ground movement along Calaveras Fault in 2015.	Approximately 40 feet of buckled pipe was replaced with WSP in 2015.
Irvington Tunnel	Unreinforced cast-in-place concrete	Cement	Cement	No documented leaks.	No major work has been done.
NIT	WSP	Tunnel	Cement mortar	New tunnel.	No major work has been done.

Pipeline	Structural Material	Coating	Lining	Leak History	Rehabilitation or Relocation
BDPL No. 1 (all)	Riveted steel (wrought), RCP from Irvington Portal to Irvington Pump Station	Coal tar	Cement mortar	Numerous leaks 1950 to 1956 in Redwood City; several leaks in East Palo Alto; no leaks after 1956.	Cement-mortar lining was placed over original coal tar lining from 1956 to 1960; CP was initiated in 1953, expanded in 1973, and overhauled in 1988; isolation valves were installed with new pipelines constructed on both sides of Hayward Fault in Fremont (BDPL Nos. 1 and 2) in 2001.
BDPL No. 1, Section C	Riveted steel (wrought), RCP from Irvington Portal to Irvington Pump Station	Coal tar	Cement mortar	A section of BDPL No. 1 was scraped by what looks like the teeth of a backhoe. The incident was reported on October 5, 2010. A small amount of water leaked into Newark Valve House. The leak was reported on September 22, 2011.	Welders installed a patch and filled the groove made by the backhoe after the incident was reported on October 5, 2010. After the plate was welded, a 1-inch IPS plug was installed and the pipe was coated. Water was pumped away shortly after September 22, 2011, but there were still leaks intermittently. There is limited access to the site because the BDPL No. 5 contractor is working in the area. This section of pipe inside the old Newark Valve House will be abandoned.
BDPL No. 1, Section E	Riveted steel (wrought), RCP from Irvington Portal to Irvington Pump Station	Coal tar	Cement mortar	During BDPL No. 5 work at Pulgas and while BDPL No. 1 was down, a corroded section was discovered and reported on April 15, 2011.	After April 15, 2011, WSTD crews cleaned out existing area around the hole. A new 3/8-inch insert was made and welded, and the plug was polished.
BDPL No. 1, Section F	Riveted steel (wrought), RCP from Irvington Portal to Irvington Pump Station	Coal tar	Cement mortar	Ongoing exposed joint leaks exist that are not completely reparable.	Replaced missing and damaged bolts to mitigate leaks. This section will be abandoned and replaced when the Bay Tunnel comes on line.
BDPL No. 2 (all)	WSP and RCP in Newark and East Palo Alto	Coal tar	Cement mortar	Five corrosion leaks from 1950 to 1955 in Redwood City (fewer than BDPL No. 1).	Cement-mortar lining was placed over the original coal tar lining from 1956 to 1960; protected by the same corrosion protection described for BDPL No. 1; the same isolation valves on Hayward fault as BDPL No. 1; no corrosion leaks since 1955.

Pipeline	Structural Material	Coating	Lining	Leak History	Rehabilitation or Relocation
BDPL No. 2, Section C	WSP and RCP in Newark and East Palo Alto	Coal tar	Cement mortar	BDPL No. 5 Contractor Ranger Pipelines noticed standing water while trenching and excavating around BDPL No. 2 area in Newark. This was reported to WSTD on July 27, 2011. A leak at Newark Valve Lot was reported on January 13, 2011. Contractor Ranger exposed a section of the pipe and created a leak.	BDPL No. 2 section was inspected and a leak on the RCP was found. Interior repairs were made by welding at two or three joints as needed in August 2011. WSTD crew assessed the leak in January 2011, and repairs were made by the contractor.
BDPL No. 2, Section F	WSP and RCP in Newark and East Palo Alto	Coal tar	Cement mortar	Ongoing exposed joint leaks exist that are not completely reparable.	Replaced missing and damaged bolts to mitigate leaks. This section will be abandoned and replaced when the Bay Tunnel comes on line.
BDPLs, Submarine Sections	Cast iron	Unknown	Cement	No documented leaks.	Internal inspection was conducted using ROVs in all five submarine pipes to detect sound of escaping water in 2004; no leaks were detected. ROV video inspection of 42-inch Submarine 1 was conducted in 1995; no visual anomalies were observed, and all joints were tight.
BDPL No. 3, Section A	RCP	Concrete	Concrete	No documented leaks.	An axial slip joint was constructed across the Hayward Fault in 1994; isolation valves were installed on both sides of Hayward Fault in 2006.
BDPL No. 3, Section B	WSP	Cement	Cement	No leaks, corrosion protection installed.	SCVWD relocated the section beneath Guadalupe River and lowered pipeline for the Coyote Creek flood channel in 1993 and 1994. Valve C20 was replaced in 2005.
BDPL No. 3, Section C	WSP	Cement	Cement	No documented leaks.	The San Tomas River crossing was relocated on a bridge above the river in 1963.
BDPL No. 3, Section D	RCP	Concrete	Concrete	No documented leaks.	Flow control valve C68 was added in 2004.

Pipeline	Structural Material	Coating	Lining	Leak History	Rehabilitation or Relocation
BDPL No. 4, Section A	PCCP	Cement	Concrete	No documented leaks.	An axial slip joint was constructed across the Hayward Fault in 1994; isolation valves were installed on both sides of Hayward Fault in 2005; electromagnetic surveys of prestressed wire were performed in 2005 and in 2013, with no major defective pipes found. A ball-pin hammer sounding test in 2013 showed that two segments have lost compression. They were replaced with steel pipes.
BDPL No. 4, Section B	WSP	Coal tar	Cement	No leaks; corrosion protection was installed in 1973.	SCVWD relocated the section beneath the Guadalupe River and lowered the pipeline for the Coyote Creek flood channel in 1993 and 1994.
BDPL No. 4, Section C	WSP	Coal tar	Cement	No documented leaks.	None.
BDPL No. 4, Section D	PCCP	Cement	Concrete	One leak was found in 1991: the bell ring was separated from the steel cylinder.	One distressed section was replaced with steel in 1991; one distressed section with reinforced in 2007; prestressed wire tests confirmed the results of the 2007 electromagnetic survey; flow control valve D68 was installed in 2004.
BDPL No. 5, East Bay Reaches (E10 to E20)	WSP	Cement	Cement	New pipe.	No pipeline modifications or alignments were made.
BDPL No. 5, Peninsula Reaches	WSP	Cement	Cement	New pipe.	No pipeline modifications or alignments.
Bay Tunnel	WSP	Tunnel	Cement mortar	New tunnel.	No major work has been done.
Stanford Tunnel	WSP in tunnel	Cement grout	Cement mortar	No documented leaks.	None.
Palo Alto Pipeline	WSP	Coal tar	Coal tar	Two leaks occurred in the 1960s; a major leak occurred in Menlo Park in 1990; a pinhole leak was caused by corrosion pitting in 2014.	A major leak was caused by the cable contractor scoring 1,000 feet of pipe with a wheel cutter in 1987, repaired by welding rolled-steel plates over the score; in 1994, approximately 700 feet were relocated on 5th Street. in Redwood City for Caltrain grade separation, and valves F40 and F45 were installed; new connections were installed to BDPL Nos. 1 and 2 in 2002; a repair was made with a 2-inch Bonney flange in 2014.

Pipeline	Structural Material	Coating	Lining	Leak History	Rehabilitation or Relocation
San Mateo Pipeline No. 2	Concrete	Concrete	Concrete	No documented leaks.	No major work has been identified. A connection to Crystal Springs, SAPL, and a golf course was reconstructed in 2000.
Pulgas Tunnel	Concrete	Tunnel	Concrete	No documented leaks.	None.
Crystal Springs Bypass Tunnel	Concrete	Tunnel	Concrete	No documented leaks.	None.
New Crystal Springs Bypass Tunnel (G32 to G38)	WSP	Cellular	Elastomeric polyurethane	New pipe.	No pipeline modifications or alignments.
Crystal Springs Bypass Pipeline	PCCP	Cement	Concrete	No documented leaks.	Landslide material was removed above the pipeline after inspection showed minimal deflections.
CSPL No. 1	WSP	Coal tar	Cement	No documented leaks.	The original 44-inch section was replaced; other segments were replaced in Brisbane in the 1980s.
CSPL No. 2, Section A	WSP	Coal tar	Coal tar	One leak was documented in 1992; during inspection in October 2000, four leak repairs were found that pre-date 1990 records. A broken valve flange was found at the blow-off near 891 Crystal Springs Road; on February 9, 2013, the flange and valve were replaced.	After 1970, the K10 to G42 connection became a stagnant leg of the Crystal Springs Bypass tunnel and pipeline; CP was installed from CSPS to El Cerrito Road.
CSPL No. 2, Section B	WSP	Coal tar	Coal tar	A cluster of six leak repairs was found during inspection in November 2006;, the leaks are assumed to pre-date 1990 records.	Original gate valves K30 and K31 were replaced with K30 in 2006; valve K20 was added in 1963.
CSPL No. 2, Section C	Riveted steel	Coal tar	Cement	No leak repairs since 1962.	Original coal tar lining was replaced with cement mortar in 1962.
CSPL No. 2, Section D	WSP	Coal tar	Coal tar	Four leaks were documented in the 1970s and 1980s.	No significant contract work has been identified.

Pipeline	Structural Material	Coating	Lining	Leak History	Rehabilitation or Relocation
CSPL No. 2, Section E	WSP	Coal tar	Coal tar	23 leak repairs were found during inspection in May 2003; all leaks predate 1990 records. A leak was reported on October 27, 2011. A blow-out at Elm Street in South San Francisco (Service 115) took place on November 25, 2011. WSIP project engineering oversight was conducted on a new section of the pipe. The design did not call for tie rods at the flexible coupling. The section was not restrained;, it moved and there was a blow out.	About 50 percent of leak repairs were near the top of Randolph Avenue; 163 feet were rebuilt beneath Colma Creek in 1980; 200 feet of coal-tar lining was replaced with epoxy in 2004. A series of Bonney flanges was welded on the pipeline to repair it after the leaks were reported on October 27, 2011. Repairs were finished and the area was backfilled with sand and turned over to Ranger pipelines for paving. The WSIP project team brought in an engineering firm to perform a failure analysis. The project team reengineered this section and instead of tie rods, the pipe was changed to ductile iron and a thrust block was poured to hold the pipe in place. WSTD crews finished repairs in the middle of June 2012, and the section was put back into service in July 2012.
CSPL No. 2, Section F	WSP	Coal tar	Coal tar with some cement	17 leak repairs were found with inspection in August 2002; most leaks in Brisbane within 1,000 feet of Main Street pre-date 1960.	Approximately 4,900 feet were relined with cement mortar, in Brisbane in (1982); approximately 5,000 feet were relocated from the trestle over the marshes in Brisbane to Cypress Lane, N. Hill Drive, and Guadalupe Parkway in 1956; approximately 1,000 feet were rebuilt along Bayshore Boulevard in 2002; CP was installed from Main Street to Geneva Avenue, from Brisbane to Daly City in 1959.
CSPL No. 2 Pipeline, Section B (K20 to K30 about 100 feet of pipe)	WSP	Tape-wrapped	Epoxy	New pipe.	No pipeline modifications or alignments.
CSPL No. 3 South	PCCP	Cement	Concrete	No documented leaks.	Approximately 1,000 feet were replaced with WSP and relocated around the expansion of Peninsula Hospital in Burlingame in 2006.

Pipeline	Structural Material	Coating	Lining	Leak History	Rehabilitation or Relocation
CSPL No. 3 North	PCCP	Cement	Concrete	No documented leaks.	Approximately 700 feet were replaced with WSP along Bayshore Boulevard as part of the Oyster Point interchange construction in 1995.
SSPL Section A	WSP	Coal tar	Coal tar	No documented leaks.	New line valve M15 was installed 60 feet downstream of G41 in 2010.
SSPL Section B	WSP	Cement	Cement	No documented leaks.	New turnout and line valve L30 was connected to CSPL No. 3 in 1970.
SSPL Section C	WSP in tunnel	Concrete	Cement	No documented leaks.	None.
SSPL Section D	WSP	Coal tar	Coal tar	Three leaks have been documented (in 1972, 1975, and 1986).	None.
SSPL Section E	WSP	Coal tar	Coal tar	Three leaks were documented on Helen Drive in the 1990s.	Original valve M41 was replaced by PRVs M41, M41A, and M41B in the late 1990s.
SSPL Section F	WSP	Coal tar	Coal tar	One leak repair found with inspection in November 2007; the leak occurred in early 1990s.	None.
SSPL Section G	WSP	Coal tar	Coal tar	No documented leaks.	Short sections were relocated by Bay Area Rapid Transit at the Colma and South San Francisco stations in the late 1990s.
SSPL Section H	WSP	Coal tar	Coal tar	No documented leaks.	The section was relocated to cross Interstate 280 on Junipero Serra Boulevard in Daly City in the mid-1960s.
SSPL Branch	Steel-welded bell and spigot	Coal tar/ asbestos wrap	Coal tar	Some redwood plugs were found during the pipeline inspection in 2014, indicating old leak repairs.	The following changes were made in 2013: 1,000 feet of the new SSBPL/HTWTP effluent 78-inch pipeline was replaced with a 60-inch pipeline. 355 feet of SSBPL 60-inch pipeline was sliplined with 48-inch steel pipe from old N42 to Meadows School. Valve N42 was replaced with valve N75. Visual and sounding inspections were done in 2014.

Pipeline	Structural Material	Coating	Lining	Leak History	Rehabilitation or Relocation
SAPL No. 1	Riveted steel (wrought)	Coal tar	Cement	10 leaks were documented from 1956 to 1988. A leak of less than 10 gpm was reported on October 19, 2010, in Millbrae close to the Office Depot parking lot.	The original pipeline delivered water from San Andreas Lake to San Francisco. North of Orange Avenue, South San Francisco, the pipeline was taken out of service in the late 1950s; approximately 5,500 feet was replaced in Millbrae west of El Camino Real; approximately 800 feet was lowered along El Camino Real in Millbrae in 1962; cement-mortar lining was applied in Millbrae to South San Francisco in 1977. WSTD crews excavated the leak and found a dime-sized hole on a 4-inch riser. Crews installed 4-inch by 2-inch saddle. The hole was backfilled and compacted after October 2010.
SAPL No. 2	Steel (lockbar) riveted joints	Coal tar	Cement	17 leaks were documented between 1953 and 1981. A corrosion leak was found in front of the Daly City Police Station in 2013; a large leak caused by corrosion of a riveted joint was found at the Junipero Serra Park Entrance in 2015.	Cement-mortar lining was applied from San Bruno to Daly City in 1984; various sections were relocated for highway construction in San Bruno, South San Francisco, and Daly City in the 1960s; a leak was repaired with a redwood plug and Bonney flange (adding galvanic anodes) in 2013; approximately 140 feet of lockbar pipeline was replaced with WSP with cement-mortar lining in 2015; 585 linear feet of pipeline was replaced for seismic reliability in 2017.
SAPL No. 3	WSP	Cement	Cement	One leak, followed by a major pipeline failure occurred in 1990.	Originally constructed as PCCP, faulty prestressed wires led to a leak in San Bruno, followed by a pipe failure in South San Francisco. The pipe was sliplined with WSP in 1993 and 1997.
SAPL No. 3 Pipeline,– Raw Water at HTWTP	WSP	Cement-mortar	Cement-mortar	A leak occurred at the blow-off on April 11, 2012.	The line was drained and interior welding repairs were done by WSTD crews. Repairs were finished in June 2012. This section will be completely replaced by the HTWTP Long-Term Improvement Project.

Pipeline	Structural Material	Coating	Lining	Leak History	Rehabilitation or Relocation
SAPL No. 3 Pipeline Section (T60 to T70)	WSP	Two coats of epoxy	Cement-mortar	New pipe.	No pipeline modifications or alignments.
Crystal Springs to SAPL	WSP	Coal tar	Cement	No documented leaks.	Major rehabilitation was performed under the WSIP (and completed in 2012).

Notes:

BDPL = Bay Division Pipeline
CP = cathodic protection
CSPL = Crystal Springs Pipeline
gpm = gallons per minute
HTWTP = Harry Tracy Water Treatment Plant
IPS = Iron Pipe Straight threaded plug
NIT = New Irvington Tunnel
PCCP = prestressed concrete cylinder pipe
PRV = pressure-relief valve
RCP = reinforced concrete cylinder pipe
ROV = remote-operated vehicle
SAPL = San Andreas Pipeline
SCVWD = Santa Clara Valley Water District
SSBPL = Sunset Branch Pipeline
SSPL = Sunset Supply Pipeline
SVWTP = Sunol Valley Water Treatment Plant
WSIP = Water System Improvement Program
WSP = welded steel pipe
WSTD = Water Supply and Treatment Division

Appendix E: Pipeline Inspection Priority Scoring and Techniques

Pipeline Inspection Priority Scoring

The following process was used to create the pipeline inspection schedule:

1. Pipelines which have already been inspected were scheduled based on their last inspection date. Steel and RCP pipelines were scheduled to be inspected every 20 years, and PCCP pipelines every 10 years.

2. Pipelines which have not already been inspected were prioritized based on an analysis of likelihood of pipeline failure and the consequences of failure.

   a. Information was collected on each pipeline segment for parameters such as material, year built, diameter, psi and type of feature, and population density.

   b. Once this information was collected, a scoring of 1 to 5 was determined for each parameter. The table below illustrates the scoring method used.

Material	Population Density	Age	Diameter	Pipeline PSI	Pipeline=5 Adit=4 Tunnel=1
PCCP = 5 Steel before welding = 2 Steel & RCP =1	rank 1 -5 1 is least density 5 is highest density	rank 1 -5 1 is newest 5 is oldest	rank 1 -5 1 is smallest diameter 5 is largest diameter	rank 1 -5 1 lowest pressure 5 is highest pressure	Pipelines are more likely to fail then tunnels

3. The next step was to calculate the total risk score from the likelihood of failure and consequences of failure analysis. Each parameter in the total risk score analysis is weighted based on the importance to system operations and past pipe break experiences. The total risk score is a summation of the weighted parameters.

Total Risk Score = Material (0.45) + Population Density (0.15) + Age (0.15) +Diameter (0.15) + PSI (0.05) + Type of Feature (0.05)

Inspection Priority Score Weighting

The table below illustrates the weighting given to each parameter.

Material	Population Density	Age	Diameter	Pipeline PSI	Pipeline =5 Adit = 4 Tunnel =1	Total Score
45%	15%	15%	15%	5%	5%	100%

Pipelines that have never been inspected were scheduled based on their total score. The highest score correlates to the pipelines with the highest likelihood of failure and/or the greatest consequences of failure.

Inspection of Welded Steel Pipe

Inspection of WSP is largely visual. An experienced engineer or inspector can detect CML that overrides corroded pipe wall. Slightly bulged mortar delineated by cracks is the telltale sign that is confirmed by scraping or tapping with a hammer to reveal a hollow sound. Corrosion of the pipe wall usually initiates at longitudinal weld seams, and over many years spreads longitudinally and circumferentially. As corrosion advances, CML occasionally falls away from the pipe wall, revealing severe corrosion. Where pipe corrosion is minimal, spot repairs are made by staff by cleaning off corrosion and applying fresh mortar. Where corrosion has become more common or extensive, the pipeline shutdown is extended (or rescheduled) and contractors are involved.

Structural flaws might also develop, particularly at joints, which are slightly weaker than in the barrel of pipe segments. Therefore, hand-applied mortar at every joint is examined for cracks, which can indicate the degree of differential ground settlement or seismic activity. Notes are taken of the degree of joint cracking, to be compared with subsequent inspections years later, to gauge changes, if any. Circumferential cracks away from joints can also indicate that unbalanced forces have acted on the pipeline. Such information is useful in determining how stable the pipeline has been during its service life. Stain gages will be installed and monitored at the Hayward and Calaveras fault crossings on BDPL No. 3 and Alameda No. 4.

A remarkable structural flaw was discovered on BDPL No. 3 in 1993 at the crossing of the Hayward Fault. Spalled CML and severely distorted pipe revealed that seismic creep of the fault was exerting high compressive forces on the pipeline. In 1992, a more subtle condition was observed in BDPL No. 4 at the same location, but no conclusions were drawn at the time. The finding in BDPL No. 3 immediately clarified what was happening to both pipelines. These findings led to the design and construction of axial slip joints for both pipelines in 1994 to absorb seismic creep.

In 2000, the effect on CSPL No. 2 was assessed from possible ground movement along San Mateo Creek. Besides examining each joint for hints of movement, engineers and crews shined lights toward each other to illuminate 50 to 100 feet of the interior at a time, to check for any slight distortions in alignment. This examination was followed by survey crews with laser instruments to check alignment. No hints of movement were detected.

Some WSP is lined with coal tar, typically older pipelines that have not yet been relined with cement mortar. After being in service for 60 years or more, coal-tar lining becomes worn in places, typically hand-applied coal tar at welded joints, where corrosion of the pipe wall has begun. Such flaws have been few and minor, with little remedial work required. A 2-mile reach of CSPL No. 2, however, has had more general wear of lining that will be repaired during shutdowns for WSIP rehabilitation.

In 2003, during inspection of CSPL No. 2 in South San Francisco a 200-foot stretch was discovered where coal-tar lining had completely failed, resulting in severe pipe corrosion throughout the stretch. In 2004, contractors were hired to vacuum out debris, clean the pipe interior to white metal, and apply state-of-the-art epoxy lining.

Interior inspection also enables a history of leak repairs to be gathered. Leaks and associated repairs have been thoroughly documented since 1990; prior to 1990 records exist, but they are less complete. In either case, leak repairs remain indelibly obvious as seen from the interior, at least in older pipelines that have not been relined with mortar. All leak repairs subsequent to relining are obvious from the redwood plugs that poke through the cement lining.

Inspection of Riveted Wrought-Steel Pipe

Visual methods of inspection are also suited for riveted pipe. These are the oldest pipelines, dating from the 1920s and earlier. All were originally lined with coal tar, and all were relined with cement between 1956 and 1964. All leak repairs prior to relining were obliterated, but the few subsequent leaks are visible from the interior.

The most common flaw in relined riveted pipe is occasional spalling of hand-applied mortar that covers longitudinal rivet courses. These pipelines were originally lined with coal tar, so exposed rivet courses still are largely protected from corrosion. Nevertheless, spalled CML is repaired as permitted by the available shutdown duration.

Inspection of Reinforced Concrete Cylinder Pipe

The full strength of RCP resides in the steel cylinder that is embedded in a thick core of high-strength concrete. Individual pipe segments are therefore rigid, so the joints need to be flexible to allow for differential ground settlement. Inspections of RCP examine each joint for signs of movement, showing either as a separation or a compression of joint mortar. Normal conditions are thin streaks of exudate between the mortar and concrete.

Inspections document general cracking of the concrete core. Longitudinal cracks in certain parts of a pipe might indicate an unbalanced vertical load. Circumferential cracks usually indicate bending forces “in beam” upon a pipe segment that the joint does not absorb. Core cracks are usually benign, not requiring repair. When appropriate, general descriptions of core cracks are forwarded to structural specialists.

Inspection of Prestressed Concrete Cylinder Pipe

Inspection methods for PCCP have evolved, responding to cases where pipe has failed suddenly. During the 1990s, visual inspection for longitudinal core cracks was augmented by manual sounding of the core with a 16-ounce hammer to listen for hollow sounds. Such sounds might indicate a structural flaw: a loss of compression in the concrete core because of corroded and broken prestressed wires wound around the outside of the core. The location and shape of the crack and hollow is critical in determining whether the flaw is structural. If a flaw is judged to be structural, the pipe must be excavated, examined, and repaired.

During inspection in 1991, a major hollow was found in the core, but without a longitudinal core crack. Excavation confirmed a large area of corroded and broken prestressed wires. The distressed pipe segment was removed and replaced with a steel segment. A complete forensic dissection of the bad pipe was conducted to reconstruct the sequence of events that led to the distress.

During the 1990s, all PCCP was carefully sounded, but no other distressed pipe segments were found. By 2002, two companies developed an electromagnetic induction technology that, from inside the pipe, could locate and quantify broken prestressed wires. Contractors were retained to inspect PCCP pipelines.

In 2005 and 2007, however, accuracy issues arose. Electromagnetic inspection identified three pipe segments as distressed, but manual sounding detected nothing. Excavation and exterior examination followed, but no broken wires were found. Inaccurate instrument calibration had been at fault.

In 2007, during visual observation of the BDPL No. 4, Section D a longitudinal distress crack was found, accompanied by a major hollow, but electromagnetic induction estimated a relatively small number of wire breaks. Excavation of the pipe found 10 times as many wire breaks as the electromagnetic survey had estimated. Again, poor calibration was the attributed factor. A PCCP specialist contractor was retained to strengthen the distressed pipe.

Electromagnetic induction will continue to be used to assess the structural condition of PCCP, but with careful monitoring of instrument calibration, and with confirming visual and sounding methods inside the pipe. For reliable results with electromagnetic induction, calibration must be done on pipe designs that exactly match the pipe segments being inspected.

Appendix F: Summary of Incidents and Possible Root Cause

Table F-1: Summary of Incidents and Possible Root Causes

Incident Reports Summary														
				Possible Root Cause										
	Name	Date	Location	Inadequate PM	Inadequate Design	Poor Specifications	Inadequate Training	Poor Procedures	Poor Communication	Operator Error	Aging Asset	Unknown	Comments
1	Tesla Chlorine (CL2) Event	July 2, 2016	TTF	✔									Back-pressure valves needed to be replaced and lines flushed of any debris. Operations to perform back-pressure valve inspections and maintenance as recommended by manufacturer.
2	ACS-1 Ammonia Leak	August 1, 2016	Alameda Siphon 1	✔									Vibration could have caused the nut connections to become loose on the injectors. Monthly preventative maintenance work order to check all siphon chemical injector connections implemented.
3	Pulgas Dechloramination Facility Discharge	August 24, 2016	Pulgas Dechloramination Facility	✔			✔		✔	✔			Equipment was past its useful life, which led to issues with the PLC transfer, VSAT communications, control logic, and operator error. Trainings to be performed, new router installed, and SCADA to implement control system changes.
4	Tesla Lamp Break UVR 2120	September 27, 2016	TTF	✔								✔	Lamp 2-2 break on UV2120. Possibly caused by sleeve scratches, lamp bulging, or lamp defects. Increase frequency of bulb and sleeve inspection. SOP updated to allow reactor to set for 15 minutes after calibrating.
5	Tesla Lamp Break UVR 2030	December 7, 2016	TTF	✔								✔	Lamp 3-1 break on UV2030. Possibly caused by sleeve scratches, lamp bulging, or lamp defects. Increase frequency of bulb and sleeve inspection. SOP updated to allow reactor to set for 1 hour after calibrating.

Incident Reports Summary														
				Possible Root Cause										
	Name	Date	Location	Inadequate PM	Inadequate Design	Poor Specifications	Inadequate Training	Poor Procedures	Poor Communication	Operator Error	Aging Asset	Unknown	Comments
6	Calaveras Pipeline Incident	January 10, 2017 through February 3, 2017	Calaveras Pipeline									✔	Flow constriction in Calaveras Pipeline due to debris blocking valve V43, which also coincided with reservoir management/creek releases due to upcoming storms. Debris was removed from V43 and reservoir levels/creek releases were maintained with ICS protocol.
7	Castlewood Reservoir Overfill	February 1, 2017	Castlewood Reservoir	✔			✔			✔			Inlet valve motor and capacitor had failed. This led to the pumps cycling too often. Operator failed to ensure that alarm was cleared once acknowledged. Replace motor and capacitor, calibrate level sensors reservoir, and retrain operators on SCADA alarm response protocols.
8	Tesla Hydrofluorosilicic acid Slug	March 20, 2017	TTF									✔	Chemical blockage on injection point. Repair and relabel equipment indicators and carrier water pumps, and repair flowmeters.
9	Sunol Valley Chloramine Facility Cracked Ammonia Flange	April 2, 2017	Sunol Valley Chloramine Facility				✔						Ammonia transfer pump flange was cracked due to overtightening. Post sign not to overtighten flange. Review SOP on tightening flanges.
10	SVWTP CCT Sodium Hypochlorite Pump Loss #1	May 7, 2017	SVWTP	✔				✔		✔			Overheated motors, ruined pumps heads, and leaking seals issues on sodium hypochlorite pumps. Install wye strainer and review SOP for LOTO of metering pumps, purchase new pumps.
11	SVWTP CCT Sodium Hypochlorite Pump Loss #2	May 11, 2017	SVWTP	✔				✔		✔			Overheated motors, ruined pumps heads, and leaking seals issues on sodium hypochlorite pumps. Install wye strainer and review SOP for LOTO of metering pumps, purchase new pumps.
12	SVWTP Fluoride Spill	May 25, 2017	SVWTP							✔			400-gallon spill from fluoride T-8620 into containment area due to drain valve that was left open. Review LOTO for drain valves to prevent future spills.

Incident Reports Summary													
				Possible Root Cause									
	Name	Date	Location	Inadequate PM	Inadequate Design	Poor Specifications	Inadequate Training	Poor Procedures	Poor Communication	Operator Error	Aging Asset	Unknown	Comments
13	SVWTP CCT Sodium Hypochlorite Pump Loss #3	June 5, 2017	SVWTP	✔				✔		✔			Overheated motors, ruined pumps heads, and leaking seals issues on sodium hypochlorite pumps. Install wye strainer and review SOP for LOTO of metering pumps, purchase new pumps.
14	SVCF Hypo. Crystallization on Hypo Pump P-101	June 7, 2017	Sunol Valley Chloramine Facility					✔					Sodium hypochlorite leak on pipe joints due to possible faulty glue joints. Work order created to repair leaks.
15	SAPS Pump #9 Stop without Alarm	June 16, 2017	SAPS						✔				No alarms received at SVWTP regarding SAPS Pump #9 stopping because there was a thermal alarm (overload alarm) level that came in before and was not reset. Operations to adjust settings for protective relays for each of the motors.
16	SAPS Hydraulic Fluid Leak	July 11, 2017	SAPS							✔			Hydraulic fluid leak at SAPS Hydraulic Room due to electrician not verifying the motor rotation. Verify motor rotation prior to pressurizing the system.
17	Tesla Loss of Remote Control for Tesla Reactor 2	July 11, 2017	Tesla and SVWTP	✔									PLC power supply failure. Resulted in loss of remote control for UV 2020 from the SVWTP. Extra PLCs to be purchased and installed.
18	Moccasin Powerhouse Failure	July 31, 2017	Moccasin							✔			The rate of Hetch Hetchy supply to the RWS was reduced to match the flow capacity of one Moccasin Powerhouse bypass, from 285 to 140 mgd from July 31, 2017, through August 2, 2017. Moccasin Powerhouse has exceeded its predicted service life, but is slated for rehabilitation.
19	HTWTP Sodium Hypochlorite Flex Hose Failure and Leak	August 4, 2017	HTWTP		✔	✔							Flex hose leak failure due to material incompatibility with chemical. Work order to purchase and install new flex hoses for sodium hypochlorite at the HTWTP.
20	SAPS Old Dechlor Building – Sodium Bisulfate Leak	August 10, 2017	SAPS Old Dechlor Building					✔					PVC line should have been capped once it was cut. Verify that work was performed on piping repairs.

Incident Reports Summary

				Possible Root Cause									
	Name	Date	Location	Inadequate PM	Inadequate Design	Poor Specifications	Inadequate Training	Poor Procedures	Poor Communication	Operator Error	Aging Asset	Unknown	Comments
21	SAPS Old Dechlor Building – Sodium Bisulfate Leak	August 11, 2017	SAPS Old Dechlor Building					✔					Fill line separated from the tank due to door closing on the line and causing a leak. Hard plumbing lines were checked, repaired, and put back into service.
22	Harry Tracy Sodium Hypochlorite offloading leak	August 14, 2017	HTWTP					✔		✔			Delivery truck shut-off valve fitting was leaking. Operators contained the spill and donned PPE to clean. Review SOP for truck deliveries.
23	San Antonio Reservoir pH Issue	August 28, 2017	San Antonio Reservoir and SAPS							✔			San Antonio Reservoir pH spiked due to the transfer pump being started prior to dechlorination. Review the sequence of pump startup and dechlorination procedure before transferring water.
24	SVWTP Ammonia Leak	September 13, 2017	SVWTP					✔		✔			Flange on tank 8410 had a leak from the while it was receiving a chemical delivery. Plumbers repaired the leak and leak tested the line.
25	Thomas Shaft Sodium Hypochlorite Pump Leak	September 19, 2017	Thomas Shaft	✔									Cracked PVC fitting caused sodium hypochlorite leak. Piping is past its useful life. Plumbers replaced piping and fitting.
26	SVCF Sodium Hypochlorite Leak	September 21, 2017	Sunol Valley Chloramines Facility							✔			Cam lock on chemical line delivery was not secure; the line disconnected from the tank, which caused a spill. Review SOP for deliveries with operators/delivery company.
27	Tesla PLC Halt	September 22, 2017	TTF									✔	PLC froze and displayed incorrect dosing values for sodium hypochlorite and fluoride pumps, and alarms did not sound. SCADA to review halt alarm status, review alarm set points, and review PM procedure.
28	Tesla Loss of Power at UV Reactors	September 27, 2017	TTF									✔	PG&E power glitch caused off spec water event when 6/7 UV reactors experienced lamp failures. Flywheel UPS units were repaired and refurbished in April 2018.
29	Tesla UV Reactor 4 – Lamp 3-2 Failure	October 2, 2017	TTF									✔	Lamp failure possibly due to dirty power and UPS' being offline. Flywheel UPS units were repaired and refurbished in April 2018.

Incident Reports Summary

				Possible Root Cause									
	Name	Date	Location	Inadequate PM	Inadequate Design	Poor Specifications	Inadequate Training	Poor Procedures	Poor Communication	Operator Error	Aging Asset	Unknown	Comments
30	Tesla UV Reactor 4 – Lamp 3-2 Failure	October 4, 2017	TTF									✔	Lamp failure possibly due to dirty power and UPS' being offline. Flywheel UPS units were repaired and refurbished in April 2018.
31	SVWTP Ammonia Leak on Flange	November 2, 2017	SVWTP	✔									Tank 8410 had a leak from the flange/gasket while it was receiving a chemical delivery. Plumbers repaired the leak.
32	Tesla Lamp Break on UV Reactor 4	November 17, 2017	TTF									✔	Lamp 1-1 broke and lamp 3-2 failed on UV 2040 due to possible dirty power or debris hitting the lamp. Repair Flywheel UPS system is completed.
33	Sunol Valley Chloramine Facility Sodium Hydroxide Leak	December 9, 2017	Sunol Valley Chloramines Facility	✔									Crack in piping on supply line. Plumbers replaced elbow and related piping.
34	SVWTP Sodium Hypochlorite Leak	December 12, 2017	SVWTP							✔			Plumber accidentally removed valve from a sodium hypochlorite pump that was online. SOP for LOTO was reviewed.
35	Tesla Power Glitch and Loss of UV Reactors	January 5, 2018	TTF									✔	Power glitch caused multiple alarms and UV power losses. Flywheel UPS units were repaired and refurbished in April 2018.
36	SVWTP Loss of Historian Trends	January 15, 2018	SVWTP									✔	Trends from Sunol servers were not reading correctly or updating. SCADA restarted the servers.
37	SVWTP Sodium Hypochlorite Leak	January 16, 2018	SVWTP					✔		✔			PVC pipe inadvertently damaged by contractor working on site. Review SOP for supervising contractors.
38	Tesla Lamp Break on UV Reactor 11	February 5, 2018	TTF									✔	Lamp 2-2 on UV 2110 broke due to possible power glitch. Flywheel UPS units were repaired and refurbished in April 2018.

Incident Reports Summary

				Possible Root Cause									
	Name	Date	Location	Inadequate PM	Inadequate Design	Poor Specifications	Inadequate Training	Poor Procedures	Poor Communication	Operator Error	Aging Asset	Unknown	Comments
39	Tesla Loss of UV Reactors and off spec water	February 5, 2018	TTF									✔	UV's experienced lamp failure alarms and off spec water event. Flywheel UPS units were repaired and refurbished in April 2018.
40	Sample Station 5 pump tripped	February 9, 2018	Pulgas Dechloramination Building							✔			Sample Station #5 tripped due to the sample pump tank running dry. Operators to check on tank during daily rounds to ensure water levels.
41	Sodium Hypochlorite Tank Pipe Break	February 13, 2018	HTWTP							✔			While cleaning the tank area, the ladder fell and broke off pipe from the sodium hypochlorite tank. Review SOP for work procedures with laborers.
42	SVCF Chlorine Overfeed	February 27, 2018	SVCF					✔		✔			Chlorine overfeed due to pump being on manual instead of automatic. Training on importance of system log check sheet. Operators to check complete operations of remote facilities once per shift, minimum.
43	Tesla Sodium Hypochlorite Tank Feed Issue	March 20, 2018	TTF	✔									Tesla sodium hypochlorite pumps were losing flow due to a collapsed storage tank liner. Liners are being removed.
44	Moccasin Dam Emergency	March 22, 2018	Moccasin		✔							✔	Record storm event presented inflows and debris flood, which overwhelmed release facilities. The Moccasin Reservoir remains out of service. This event coincided with a planned system shutdown, and the returned to service date was met using Moccasin Reservoir Bypass.
45	SVWTP Clearwell Sodium Hypochlorite Flushing	April 16-18, 2018	SVWTP				✔	✔					SVWTP was performing flushing at Sodium Hypochlorite system to prepare for in-house project. Flushing plan was not properly reviewed prior to execution and neither were proper pumps into specified locations.
46	Tesla Off-Spec Water	April 16, 2018	TTF	✔									UVR 2020 flow control valve was opening even though the reactor itself was not treating water. This lead to an off-spec water event. EMT's disclosed that the issue was a low PLC battery (which has since been replaced).

Incident Reports Summary

				Possible Root Cause									
	Name	Date	Location	Inadequate PM	Inadequate Design	Poor Specifications	Inadequate Training	Poor Procedures	Poor Communication	Operator Error	Aging Asset	Unknown	Comments
47	SVCF Pump Failures	April 20, 2018	SVCF									✔	Multiple pump failures occurred with a possible cause of an RIO-7 signal loss. The pumps were first restarted in manual and then returned to auto mode. SCADA installed traps to identify cause.
48	SAPS Sodium Bisulfite Leak	May 14, 2018	SAPS	✔	✔								Chemical delivery driver accidentally overfilled the Sodium Bisulfite tanks which led to a chemical overflow within the building. Proper procedures to be taken when offloading chemicals.
49	Pulgas Pump Station Power Outage	May 22, 2018	Pulgas Pump Station					✔	✔				Pulgas Pump Station experienced a power outage which caused the Bailey Valve control panel and actuator to lose power. The Bailey valve motor has since been rebuilt and is operating. Programming changes have been made for its duty cycling.
50	SVCF Sodium Hypochlorite Pump Failure	May 25, 2018	SVCF	✔									Sodium Hypochlorite Pump was dropping off in rate. Cause was due to a bad stator on the pump which has since been replaced.
51	SVCF Chemical Pump Failure	May 26, 2018	SVCF		✔								Multiple pump losses after the equipment ramped up to full speed. Pumps were ran in manual. SCADA explains the possible cause as a RIO-7 signal loss and has installed traps within the system to monitor future issues.
52	SVCF Sodium Hypochlorite Pump Loss Event #1	June 1, 2018	SVCF	✔									The Sodium Hypochlorite pumps were trying to fulfill desired feed rate once it suddenly fell to zero. In addition, there were negative speed alarms which triggered that the cause could be within the control cabinet. The pumps were then put in manual. SCADA redid some programming which corrected the issue.
53	SVCF Sodium Hypochlorite Pump Loss Event #2	June 4, 2018	SVCF	✔									Sodium Hypochlorite pumps were again experiencing fluctuations in pump speed and were put in manual. SCADA redid some programming which corrected the issue.

Incident Reports Summary

				Possible Root Cause									
	Name	Date	Location	Inadequate PM	Inadequate Design	Poor Specifications	Inadequate Training	Poor Procedures	Poor Communication	Operator Error	Aging Asset	Unknown	Comments
54	SVCF Sodium Hydroxide Leak	June 5, 2018	SVCF	✔									Sodium Hydroxide pump P-303 had a leak at the discharge union. Approximately 100 gallons of caustic leaked into secondary containment and was cleaned and properly disposed of.
55	SVWTP SCADA Switch Failure	June 6, 2018	SVWTP	✔									CISCO switch in SCADA room failed which caused East Bay to lose primary communication. Replacement switch was later installed and communication was restored.
56	TTF UVR 2030 Lamp 2-2 Break	June 10, 2018	TTF									✔	UVR 2030 Lamp 2-2 broke along with its sleeve. UVR was taken out of service and another UVR took its place for treating water. Cause is under investigation with Calgon.
57	TTF UVR 2080 Lamp 3-1 Break	June 14, 2018	TTF									✔	UVR 2080 Lamp 3-1 broke along with its sleeve. UVR was taken out of service and another UVR took its place for treating water. Cause is under investigation with Calgon.
58	SVWTP Low Chemical Feed at Filter 8	June 28, 2018	SVWTP	✔									Filter 8 flow meter readings were off which in turn affected the chemical dosing from the chemical pumps. Once the issue was acknowledged, filter 8 was taken offline and filter 9 took its place for correct dosing.
59	TTF UVR 2090 Lamp 2-1 Break	July 2, 2018	TTF									✔	UVR 2090 Lamp 2-1 broke along with its sleeve. UVR was taken out of service and another UVR took its place for treating water. Cause is under investigation with Calgon.
60	TTF Fluoride Pump Loss	July 11, 2018	TTF	✔				✔					Fluoride pump was unable to operate since no UPS power can reach P-4250. This is caused because UPS-3023 was out for maintenance and pump was not tagged out properly.
61	PDC Chlorinated Discharge	July 13, 2018	PDC		✔								Possible inadequate mixing in the outlet box and that the Bailey Valve was O/S and not operating in auto which does not compensate for low flow.
62	TTF UVR 2060 Lamp 1-1 Break	July 17, 2018	TTF									✔	UVR 2060 Lamp 1-1 broke along with its sleeve. UVR was taken out of service and another UVR took its place for treating water. Cause is under investigation with Calgon.

Incident Reports Summary

				Possible Root Cause									
	Name	Date	Location	Inadequate PM	Inadequate Design	Poor Specifications	Inadequate Training	Poor Procedures	Poor Communication	Operator Error	Aging Asset	Unknown	Comments
63	SAPS Diesel Spill	July 25, 2018	SAPS	✔									Diesel spill of approximately 7,000 gallons at SAPS was contained on site. Possible cause was the diesel day tank level indicator malfunctioned and caused the transfer pumps to keep on cycling. Clean up was complete and WO to fix issues at SAPS are underway.
64	TTF Sodium Hypochlorite Feed System	July 26, 2018	TTF	✔				✔					Sodium Hypochlorite Pump #1, P-3080, failed. The second post-chlorination pump that was online, pump #2 (P-3200), did not increase its speed to compensate for the lack of flow. A chlorine back-up event was triggered.

Notes:
CCT = Chlorine Contact Tank
ICS = Incident Command System
HTWTP = Harry Tracy Water Treatment Plant
LOTO = lockout-tagout
mgd = million gallons per day
PG&E - Pacific Gas and Electric Company
PLC = programmable logic controller
PM = preventive maintenance
PPE = personal protective equipment
PVC = polyvinyl chloride
RWS = Regional Water System
SAPS = San Antonio Pump Station
SCADA = Supervisory Control and Data Acquisition
SOP = standard operating procedures
SVCF = Sunol Valley Chloramination Facility
SVWTP = Sunol Valley Water Treatment Plant
TTF = Tesla Treatment Facility
UPS = Uninterruptible Power Supply
UV = ultraviolet
VSAT = very small aperture terminal

Appendix G: Project Closeout Summary

Table G-1: Summary of Project Closeout Data

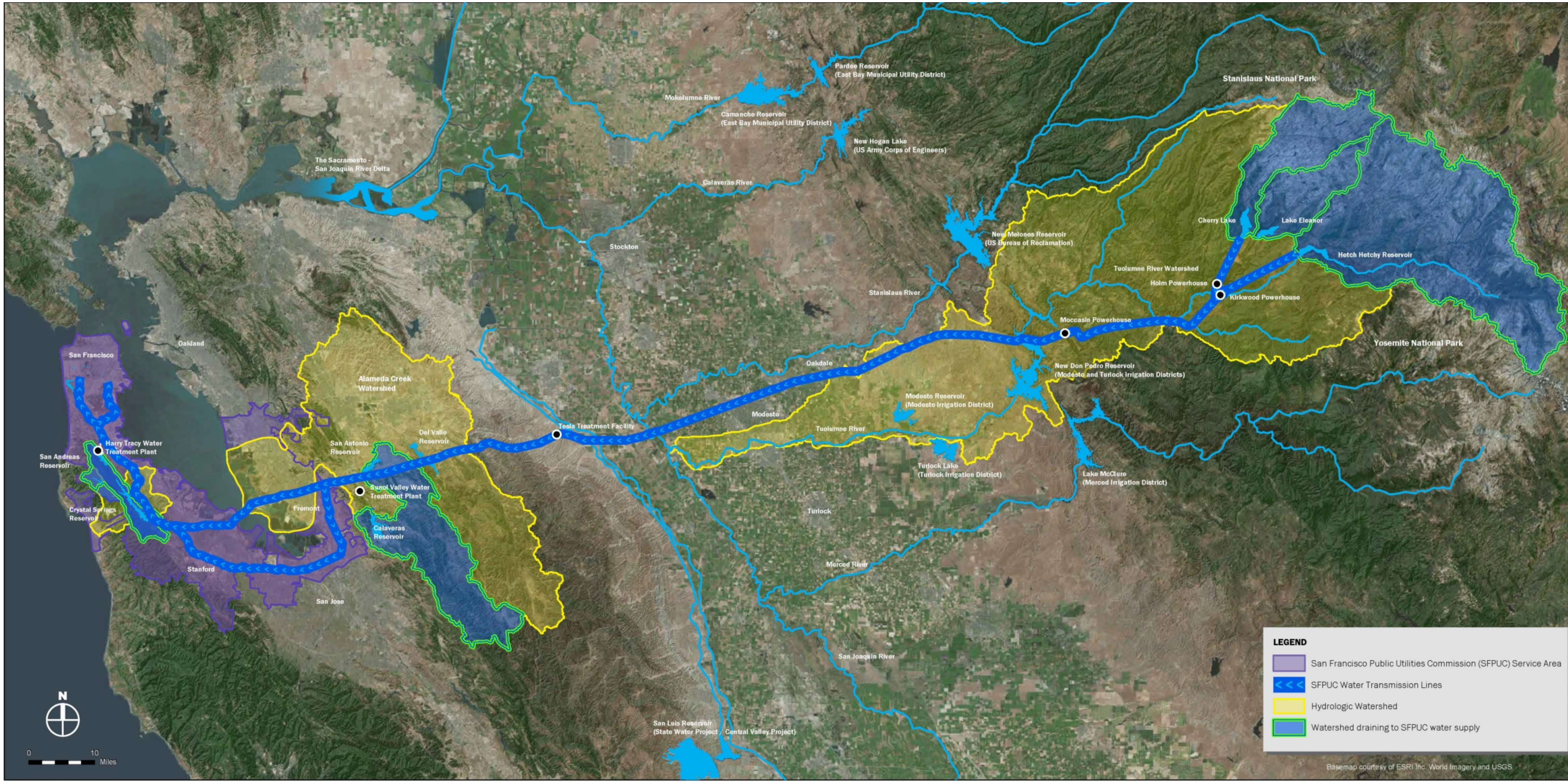
WSIP Project Name	Forecast (or Actual) Construction Contract Final Completion Date	Project Status	Received O&Ms	Received Equipment Data Sheets	Received Record Drawings	Received As-Builts
San Joaquin Region						
Lawrence Livermore Laboratory and Thomas Shaft Improvements	March 11, 2011	Closed	August 10, 2011	August 16, 2011	August 12, 2012	May 30, 2013
Rehabilitation of Existing San Joaquin Pipelines (Roselle Crossover Package Only)	September 19, 2011	Closed	December 14, 2012	September 25, 2013	September 4, 2014	September 25, 2013
San Joaquin Pipeline System – Crossovers and Other Fac (Contract 1)	May 12, 2015	Closed	September 25, 2013	September 25, 2013	August 23, 2013	May 6, 2013
San Joaquin Pipeline System – Western Segment (Contract 2 or B)	October 24, 2013	Closed	February 2014	June 20, 2013	October 23, 2014	October 23, 2014
San Joaquin Pipeline System – Eastern Segment (Contract 3 or C)	October 31, 2014	Closed	October 27, 2014	October 27, 2014	October 14, 2015	June 25, 2015
TTF (Design-Build Project)	November 30, 2012	Closed	October 15, 2013	July 6, 2012	N/A	May 2, 2014
Tesla Portal Protection (HH-953)	October 31, 2014	Closed	February. 2014	July 22, 2014	February 24, 2014	November 24, 2015
San Joaquin Pipeline System – West Interstate 5	March 15, 2014	Closed	N/A	N/A	June 12, 2016	N/A
San Joaquin Pipeline System – East Oakdale Portal	June 30, 2014	Closed	N/A	April 17, 2015	January 27, 2016	January 27, 2016
Sunol Valley Region						
Pipeline Repair and Readiness Improvements Project	October 15, 2008	Closed	August 2, 2011	N/A	March 27, 2013	June 25, 2012
Standby Power Facilities – Various Locations (East Bay)	October 27, 2008	Closed			March 12, 2013	April 4, 2013
Standby Power Facilities – Various Locations (Peninsula)	May 28, 2010	Closed	Partial Submittal March 1, 2010		February 7, 2013	July 18, 2012
SAPS Upgrades	September 30, 2011	Closed	Partial Submittal July 1, 2011	Partial Submittal December 21, 2012	April 24, 2013	July 5, 2012
Alameda No. 4	August 24, 2012	Closed	April 18, 2014 99% done	April 18, 2014 Done	N/A	June 2013
SVWTP Expansion and Treated Water Reservoir	September 20, 2013	Closed	April 18, 2014	April 18, 2014	August 15, 2014	June 2, 2014
SABPL	December 31, 2015	Closed	April 29, 2016	April 29, 2016	March 22, 2017	March 22, 2017
NIT	August 30, 2016	Closed	August 19, 2016	August 19, 2016	March 19, 2018	May 31, 2018
CDRP	April 26, 2019	Construction	Partial Submittal December 9, 2013	Partial Submittal December 9, 2013		
Calaveras Reservoir Oxygenation Project	October 11, 2005	Closed	December 10, 2012	N/A	N/A	December 5, 2012
Alameda Creek Recapture Project		Preconstruction				
Fish Passage Facilities in Alameda Creek Watershed	April 21, 2018	Construction				
SVWTP Polymer Feed Facility		Preconstruction				

WSIP Project Name	Forecast (or Actual) Construction Contract Final Completion Date	Project Status	Received O&Ms	Received Equipment Data Sheets	Received Record Drawings	Received As-Builts
Bay Region						
BDPL Nos. 3 and 4 Crossover/Isolation Valves	January 11, 2008	Closed	Partial Submittal November 25, 2013		June 25, 2012	May 1, 2013
SFPUC/EBMUD Intertie	January 31, 2008	Closed	March 28, 2014		February 27, 2013	June 28, 2012
SCADA System Phase II	February 28, 2011	Closed	June 21, 2012		February 7, 2013	June 19, 2012
BDPL Reliability Upgrade – Pipeline (East Bay)	June 15, 2012	Closed	December 12, 2013	December 2, 2015	July 9, 2013	August 23, 2013
BDPL Reliability Upgrade – Pipeline (Peninsula)	January 31, 2014	Closed	December 12, 2013	November 2, 2015	July 9, 2013	March 22, 2013
BDPL Nos. 3 and 4 Crossovers	December 31, 2013	Closed	January 31, 2013	April 12, 2013	September 10, 2012	September 16, 2013
BDPL Reliability Upgrade – Pipeline (Cordilleras MicroTunnel)	April 18, 2014	Closed	December 30, 2013	June 6, 2013	November 4, 2013	June 4, 2013
Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	September 30, 2016	Construction	August 29, 2017	August 29, 2017	November 29, 2017	November 29, 2017
BDPL Reliability Upgrade – Tunnel	May 30, 2016	Closed	July 19, 2016	August 28, 2019	July 22, 2016	November 30, 2016
Peninsula Region						
Pulgas Balancing – Inlet/Outlet Work	February 2, 2006	Closed	2013	2013	June 24, 2013	November 26, 2012
HTWTP – Short-Term Improvements – Demo Filters	February 27, 2006	Closed	May 23, 2013	N/A	April 24, 2013	April 1, 2013
Adit Leak Repair – Crystal Springs, Calaveras, and San Antonio Dams Outlet Towers	March 5, 2008	Closed	N/A	N/A	N/A	N/A
Capuchino Valve Lot Improvements	March 5, 2008	Closed			June 24, 2013	April 3, 2014
Cross Connection Controls (Phase 2)	November 26, 2008	Closed	N/A	N/A	N/A	N/A
Pulgas Balancing – Discharge Channel Modifications	December 7, 2009	Closed			June 24, 2013	April 3, 2014
HTWTP – Short-Term Improvements – Coagulation and Flocculation/Remaining Filters	March 31, 2010	Closed	June 19, 2012	N/A	April 24, 2013	June 19, 2012
SAPL No. 3 Installation	June 30, 2011	Closed	August 19, 2011	August 23, 2012	June 19, 2012	December 30, 2013
New Crystal Springs Bypass Tunnel	August 12, 2011	Closed	June 19, 2012	N/A	October 29, 2012	June 17, 2014
Pulgas Balancing – Structural Rehabilitation and Roof Replacement of the Reservoir	September 1, 2011	Closed			April 24, 2013	March 12, 2013
Baden San Pedro Valve Lots Improvements	December 30, 2011	Closed	February 21, 2013	November 10, 2011	February 7, 2013	July 23, 2012
LCSD Improvements	May 1, 2012	Closed	N/A	N/A	March 15, 2012	March 12, 2013
Pulgas Balancing – Modifications of the Existing Dechloramination Facility	March 20, 2013	Closed	June 18, 2013		April 24, 2013	January 14, 2013
CSPL No. 2 Replacements	March 30, 2013	Closed	April 30, 2013	April 30, 2013	April 30, 2013	July 17, 2013
Crystal Springs/San Andreas Transmission Upgrade	December 31, 2014	Closed	June 30, 2015	95% Done March 31, 2015	August 11, 2015	September 17, 2015

WSIP Project Name	Forecast (or Actual) Construction Contract Final Completion Date	Project Status	Received O&Ms	Received Equipment Data Sheets	Received Record Drawings	Received As-Builts
HTWTP Long–Term Improvements	July 29, 2016	Closed	August 10, 2016	December 8, 2016	October 18, 2016	March 23, 2018
PPSU	February 29, 2016	Closed	March 3, 2016	March 3, 2016	December 2, 2016	June 27, 2017
LCSD Stilling Basin and Valve H53 Repair		Preconstruction				
San Francisco Regional Region						
Sunset Reservoir North Basin Embankment Stabilization	November 11, 2006	Closed	November 19, 2012	November 19, 2012		August 22, 2012
Sunset Reservoir Upgrades – North Basin	August 29, 2008	Closed	October 2010	October 2010	October 2010	October 2010
University Mound Reservoir Upgrades- North Basin	August 23, 2011	Closed	June 22, 2012	May 30, 2013	N/A	August 22, 2013
Regional Groundwater Storage and Recovery (Phase 1)	January 6/2018	Construction				
Regional Groundwater Storage and Recovery (Phase 2)		Preconstruction				

Notes:
BDPL = Bay Division Pipeline
CDRP = Calaveras Dam Replacement Project
CSPL = Crystal Springs Pipeline
EBMUD = East Bay Municipal Utility District
HTWTP = Harry Tracy Water Treatment Plant
LCSD = Lower Crystal Springs Dam
N/A = not applicable
NIT = New Irvington Tunnel
O&M = operations and maintenance
PPSU = Peninsula Pipelines Seismic Upgrade
SABPL = San Antonio Backup Pipeline
SAPL = San Andreas Pipeline
SAPS = San Antonio Pump Station
SCADA = Supervisory Control and Data Acquisition
SFPUC = San Francisco Public Utilities Commission
SVWTP = Sunol Valley Water Treatment Plant
TTF = Tesla Treatment Facility
WSIP = Water System Improvement Program

Appendix H: Watershed Map



Appendix I: Proposed Level of Service

In 2008, the SFPUC adopted Level of Service Goals and Objectives (Levels of Service) for the Water Enterprise in conjunction with the approval of the Water System Improvement Program Programmatic Environmental Impact Report. Those Levels of Service provided the basis for many of the WSIP project designs. These updated and expanded LOS Goals and Objectives build from the base of those adopted in 2008. They retain the 2008 Levels of Service and carry them forward with additions to be sure that Levels of Service are maintained and to cover areas that were not included in 2008, such as In-City Delivery Reliability. Also, a number of Levels of Service Objectives have been added that relate to our workforce and our role in the communities we serve, consistent with the SFPUC's 2020 Strategic Plan.

OUR VALUES:

Service

Excellence

Stewardship

Diversity

Safety

Inclusiveness

Communication

Trust

Equal Opportunity

Respect

Teamwork

ENVIRONMENTAL STEWARDSHIP – *maintain high environmental performance standards*

- Meet all current and anticipated environmental legal requirements.
- Manage natural resources and physical systems to protect watershed lands and their ecosystems.
- Provide the public with appropriate educational opportunities by maintaining active education programs and recreational opportunities (where appropriate) in cooperation with other federal, state and local agencies.
- Manage and operate the Water Enterprise assets consistent with the Water Enterprise Environmental Stewardship Policy.

SUSTAINABILITY – *enhance sustainability in all system activities (environmental, economic and social)*

Energy Utilization

- Maintain a gravity-driven water system.
- Minimize carbon footprint of all water system operations through sustainable design and operational practices.

Workforce Support

- Attract, develop, and retain a healthy, safe, well-trained, productive, and well-equipped workforce, reflective of the communities we serve.
- Provide and promote opportunities for knowledge transfer and staff development in areas critical to meeting LOS goals and objectives.

Community Support

- Be mindful of and responsive to community needs throughout the water system, consistent with maintaining the water system.
- Maintain active program of public outreach regarding all aspects of the water system.

Cost-effectiveness

- Ensure cost-effective use of funds.
- Provide water meter data for fair and timely billing of both wholesale and retail water customers, as well as effective management of water supplies.
- Implement effective management programs for all assets (facilities, lands and equipment), including:
  – Regular updates of asset inventories.
  – Regular inspection (or predictive monitoring) and maintenance.
  – Appropriate repair and replacement.

Strategic Planning

- Continually evaluate and plan for changing environmental, fiscal and social conditions, (e.g. climate change, development, regulation and other factors outside of the SFPUC's control) that influence the ability to achieve these levels of service.

San Francisco Water System Level of Service Goals & Objectives

UPDATED AND EXPANDED
October 2017

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

DRINKING WATER QUALITY – *maintain high water quality*

- Comply with or surpass all current and foreseeable future federal and state drinking water quality requirements.
- Provide clean, unfiltered water originating from Hetch Hetchy Reservoir, filtered water from local watersheds, and appropriately treated water from other local sources.
- Continue to implement watershed protection measures in the Peninsula, Alameda and Tuolumne watersheds to protect watershed ecosystems and drinking water quality.

REGIONAL DELIVERY RELIABILITY – *maintain post-WSIP delivery reliability and ability to maintain the system*

- Provide operational flexibility to allow planned maintenance shutdown of individual facilities without interrupting customer service.
- Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages.
- Maintain emergency response and recovery plans for major delivery assets to minimize the duration of unplanned outages.
- Provide operational flexibility and system capacity to replenish local reservoirs as needed.
- Meet the estimated average annual demand of up to 300 mgd under the conditions of one planned shutdown of a major facility for maintenance concurrent with one unplanned facility outage due to a natural disaster, emergency, or facility failure/upset.[1]
- Maintain security for all facilities consistent with the National Infrastructure Protection Plan and Environmental Protection Agency guidelines.
- Provide Wholesale Customers with timely information and data sufficient to support operational decision-making of their retail systems.

1 Based on assumptions in Section 5 of November 11, 2006 WSIP System Assessment for Levels of Service Objectives Report.
2 More detailed levels of service to be developed through AWSS analysis.

REGIONAL SEISMIC RELIABILITY – *maintain ability to meet current seismic standards*

- Design water system improvements to meet current seismic standards, and over time regularly evaluate the ability of the system to meet current seismic standards.
- Deliver basic service to the three regions in the service area (East/South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. Basic service is defined as average winter-month usage, and the performance objective for design of the regional system is 229 mgd. The performance objective is to provide delivery to at least 70 percent of the turnouts in each region, with 104, 44, and 81 mgd delivered to the East/South Bay, Peninsula, and San Francisco, respectively.
- Restore facilities to meet average-day demand of up to 300 mgd within 30 days after a major earthquake.

IN-CITY SEISMIC RELIABILITY – *reduce vulnerability to earthquakes*

- **Storage.** Maintain seismically reliable storage to provide at least two days average day demand plus minimum 2 hours fire suppression at 3 hydrants (5,000 gpm combined flow) in each pressure zone.
- **Fire Suppression.** In conjunction with the Auxiliary Water Supply System, within one hour of a major earthquake, provide at least 50% anticipated water demand from post-seismic fires in each of 46 Fire Response Areas, and at least 90% City-wide average water demand from post-seismic fires.[2]
- **Water Supply Restoration.** Provide water to support flushing, bathing/cleaning, and consumption if boiled or disinfected.
  - Within 24 hours, limited network of critical transmission mains (≥ to 12-inch diameter) that serve critical care facilities will be pressurized.
  - Within 72 hours, limited network of critical secondary distribution system pipelines (< 12-inch diameter) will be pressurized.
  - Within 7 days, limited network of critical transmission and distribution mains will be disinfected and restored to potable service.
  - Within 90 days, secondary distribution system will be restored to potable service.

IN-CITY DELIVERY RELIABILITY – *reliably deliver water to all in-City retail customers*

- Maintain minimum pressure of 20 psi throughout distribution system.
- Respond to 100% of customer service inquiries or complaints regarding water service within 2 business hours of initial contact.
- Maintain deliveries such that ≤ 0.1% of service connections are without water for 4 hours or less as a result of an unplanned outage per year.
- Maintain deliveries such that ≤ 0.01% of service connections are without water for 12 hours or more as a result of an unplanned outage per year.
- Maintain security for all facilities consistent with the National Infrastructure Protection Plan and Environmental Protection Agency guidelines.

WATER SUPPLY – *meet customer water needs in non-drought and drought periods*

- Meet average annual water demand of 265 mgd from the SFPUC watersheds for retail and wholesale customers during non–drought years for system demands through 2018.
- Meet dry-year delivery needs through 2018 while limiting rationing to a maximum 20 percent system-wide reduction in water service during extended droughts.
- Diversify water supply options during non-drought and drought periods.
- Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers.
- Maintain San Francisco retail residential potable water use below 50 gallons per capita per day.
- Irrigate 30% of San Francisco's Recreation and Park Department lands with recycled water by 2021.
- Implement projects and programs that advance the OneWaterSF Vision of optimizing the use of finite resources to balance community and ecosystem needs and create a more resilient future.

Appendix J: FY 19-28 CIP Project Level Detail

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

Appendix J – FY 19-28
CIP Project Level Detail

Water Enterprise

Capital Plans

	A	B	C	D	E	F	G	H	I	J	K	L		M	N	O
1	USES	Available Balance as of 6/30/2017	FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	1	FY 18-27	FY 19-28	Change
2	**Regional Water**												2			
3	**Water Treatment Program**												3			
4	All Water Treatment Program	12,340,000											4			
5	Tesla UV Facility		1,272,000	1,272,000	280,000	280,000	280,000	280,000	305,000	305,000	305,000	337,000	5	2,875,000	4,916,000	2,041,000
6	SVWTP & East Bay Fields		3,033,000	3,550,000	700,000	450,000	350,000	350,000	350,000	350,000	350,000	350,000	6	4,703,000	9,833,000	5,130,000
7	HTWTP & West Bay Fields		2,214,000	1,221,000	1,228,000	1,234,000	1,234,000	1,248,000	1,275,000	1,317,000	1,324,000	1,340,000	7	14,997,000	13,635,000	(1,362,000)
8	SVWTP Ozone - NEW		4,000,000	8,000,000	103,000,000	-	-	-	-	-	-	-	8	-	115,000,000	115,000,000
9	SVWTP Powder Activated Carbon Units - NEW		4,745,000	440,000	280,000	-	-	-	-	-	-	-	9	-	5,465,000	5,465,000
10	Reg. GW Storage and Recovery Project (Post WSIP) - NEW		50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	10	-	500,000	500,000
11	Subtotal	12,340,000	15,314,000	14,533,000	105,538,000	2,014,000	1,914,000	1,928,000	1,980,000	2,022,000	2,029,000	2,077,000	11	22,575,000	149,349,000	126,774,000
12	**Water Transmission Program**												12			
13	All Water Transmission Program	21,209,552											13			
14	Corrosion Protection Capital Upgrades		2,750,000	4,060,000	1,940,000	1,475,000	1,475,000	1,690,000	1,690,000	1,690,000	1,690,000	1,890,000	14	19,090,000	20,350,000	1,260,000
15	Pipeline Inspection and Repair Project		3,460,000	2,120,000	2,120,000	1,560,000	1,560,000	1,560,000	1,560,000	1,560,000	1,560,000	1,560,000	15	10,910,000	18,620,000	7,710,000
16	Pump Station Upgrades		1,180,000	3,680,000	2,180,000	3,280,000	3,680,000	21,216,000	6,230,000	1,278,000	1,285,000	1,290,000	16	15,182,000	45,299,000	30,117,000
17	Pipeline Improvement Program		22,250,000	900,000	1,150,000	500,000	500,000	1,500,000	1,500,000	2,500,000	2,500,000	5,500,000	17	157,193,000	38,800,000	(118,393,000)
18	CS2 in Hillsborough Improvements (Reaches 2 & 3)		1,750,000	27,120,000	27,130,000	-	-	-	-	-	-	-	18	-	56,000,000	56,000,000
19	Palo Alto Pipeline Replacement		-	-	-	-	3,000,000	4,000,000	5,000,000	10,000,000	28,000,000	40,000,000	19	-	90,000,000	90,000,000
20	Valve Replacement		7,700,000	6,300,000	4,700,000	1,700,000	1,350,000	1,390,000	1,398,000	1,450,000	1,465,000	1,476,000	20	18,788,000	28,929,000	10,141,000
21	Vault Upgrades		675,000	675,000	675,000	675,000	675,000	694,000	707,000	740,000	750,000	757,000	21	6,931,000	7,023,000	92,000
22	Metering Upgrades		200,000	200,000	200,000	200,000	200,000	206,000	206,000	220,000	224,000	226,000	22	2,052,000	2,082,000	30,000
23	BDPL 1&2 Decommissioning - NEW				2,250,000	2,250,000							23		4,500,000	4,500,000
24	Subtotal	21,209,552	39,965,000	45,055,000	42,345,000	11,640,000	12,440,000	32,256,000	18,291,000	19,438,000	37,474,000	52,699,000	24	230,146,000	311,603,000	81,457,000
25	**Water Supply and Storage Program**												25			
26	All Water Supply and Storage Program	12,550,096											26			
27	Dam Structural Upgrades (w/ geotech)		3,800,000	2,300,000	15,400,000	1,998,000	1,848,000	972,000	583,000	598,000	598,000	550,000	27	24,031,000	28,647,000	4,616,000
28	Desalination		-	-	-	-	-	-	-	-	-	-	28	-	-	-
29	Purified Water & Other Supplies		2,600,000	1,000,000	3,500,000	4,300,000	4,000,000	4,000,000	20,000,000	20,000,000	-	-	29	117,500,000	59,400,000	(58,100,000)
30	Daly City Recycled Water Expansion Project - NEW					29,750,000	35,000,000	20,250,000	-	-	-	-	30	85,000,000	85,000,000	-
31	San Andreas Dam Facility Improvement		2,100,000	3,300,000	32,000	32,000	32,000	33,000	10,033,000	5,035,000	5,035,000	40,000	31	15,040,000	25,672,000	10,632,000
32	Turner Dam and Reservoir Improvements		450,000	450,000	1,100,000	8,500,000	650,000	-	-	-	-	-	32		11,150,000	11,150,000
33	Merced Manor Reservoir Facilities Repairs		6,432,000	-	-	-	-	-	-	-	-	-	33	7,023,000	6,432,000	(591,000)
34	Subtotal	12,550,096	15,382,000	7,050,000	20,032,000	44,580,000	41,530,000	25,255,000	30,616,000	25,633,000	5,633,000	590,000	34	248,594,000	216,301,000	(32,293,000)
35	**Watersheds and Land Management**												35			
36	All Watersheds and Land Management												36			
37	Watershed Cottages/Buildings Upgrade	11,854,070	-	-	-	-	-	-	-	-	-	-	37	4,928,000	-	(4,928,000)
38	Bay Area Watershed and ROW Protection Program		1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	38	-	10,000,000	10,000,000
39	Long Term Monitoring & Permit Program (Capital) - NEW	3,321,092	10,076,000	11,521,000	4,119,000	3,924,000	3,457,000	3,374,000	1,782,000	1,538,000	1,596,000	1,621,000	39	-	43,008,000	43,008,000
40	Subtotal	15,175,162	11,076,000	12,521,000	5,119,000	4,924,000	4,457,000	4,374,000	2,782,000	2,538,000	2,596,000	2,621,000	40	4,928,000	53,008,000	48,080,000
41	**Communication and Monitoring Program**												41			
42	All Communication and Monitoring Program	4,610,444											42			
43	Microwave Backbone Upgrade		450,000	-	-	-	-	-	-	-	-	1,000,000	43	900,000	1,450,000	550,000
44	WST Security System		500,000	500,000	500,000	500,000	500,000	515,000	515,000	515,000	515,000	520,000	44	5,104,000	5,080,000	(24,000)
45	Subtotal	4,610,444	950,000	500,000	500,000	500,000	500,000	515,000	515,000	515,000	515,000	1,520,000	45	6,004,000	6,530,000	526,000
46	**Buildings and Grounds Program**												46			
47	All Buildings and Grounds Program	9,816,111											47			
48	Sunol Yard Upgrade		286,000	295,000	304,000	313,000	322,000	333,000	335,000	335,000	335,000	335,000	48	6,226,000	3,193,000	(3,033,000)
49	Millbrae Yard Upgrade		1,500,000	1,500,000	500,000	500,000	515,000	530,000	530,000	530,000	530,000	530,000	49	12,623,000	7,165,000	(5,458,000)
50	Sunol Long Term (Watershed Center)		28,750,000	2,500,000	2,500,000	-	-	-	-	-	-	-	50	-	33,750,000	33,750,000
51	Buildings & Grounds All Locations		1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,000,000	1,000,000	1,000,000	1,000,000	51	-	13,000,000	13,000,000
52	Millbrae Long Term		2,700,000	27,000,000	2,800,000	-	-	-	-	-	-	-	52	-	32,500,000	32,500,000
53	Rollins Road Building		850,000	750,000	500,000	400,000	400,000	350,000	350,000	350,000	350,000	350,000	53	-	4,650,000	4,650,000
54	Subtotal	9,816,111	35,586,000	33,545,000	8,104,000	2,713,000	2,737,000	2,713,000	2,215,000	2,215,000	2,215,000	2,215,000	54	18,849,000	94,258,000	75,409,000
55	**Base Funded by WSIP**												55			
56	Regional Groundwater Storage and Recovery (WSIP)	22,837,812	7,000,000	-	-	-	-	-	-	-	-	-	56	-	7,000,000	7,000,000
57	Alameda Creek Recapture (WSIP)	17,836,549	3,000,000	-	-	-	-	-	-	-	-	-	57	-	3,000,000	3,000,000
58	Alameda Creek Diversion Dam (WSIP)	-	5,000,000	-	-	-	-	-	-	-	-	-	58	7,000,000	5,000,000	(2,000,000)
59	Calaveras Dam (WSIP)	33,081,096	34,000,000	-	-	-	-	-	-	-	-	-	59	40,000,000	34,000,000	(6,000,000)
60	WSIP Closeout - Bay Division	-	2,000,000	-	-	-	-	-	-	-	-	-	60	-	2,000,000	2,000,000
61	WSIP Closeout - Peninsula (WSIP)	-	7,000,000	-	-	-	-	-	-	-	-	-	61	-	7,000,000	7,000,000
62	WSIP Closeout - San Joaquin Region	-	2,000,000	-	-	-	-	-	-	-	-	-	62	-	2,000,000	2,000,000
63	Joint Infrastructure	-	2,000,000	-	-	-	-	-	-	-	-	-	63	-	2,000,000	2,000,000
64	Subtotal	73,755,457	62,000,000	-	-	-	-	-	-	-	-	-	64	47,000,000	62,000,000	15,000,000
65													65			
66	REGIONAL WATER TOTAL	149,456,822	180,273,000	113,204,000	181,638,000	66,371,000	63,578,000	67,041,000	56,399,000	52,361,000	50,462,000	61,722,000	66	578,096,000	893,049,000	314,953,000

	A	B	C	D	E	F	G	H	I	J	K	L		M	N	O
1	USES	Available Balance as of 6/30/2017	FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	1	FY 18-27	FY 19-28	Change
67	**Local Water**												67			
68	Local Water Conveyance / Distribution System	58,516,247	56,100,000	56,100,000	57,000,000	58,000,000	59,000,000	60,000,000	61,000,000	62,000,000	64,000,000	67,300,000	68	561,000,000	600,500,000	39,500,000
69	Sunset Pipeline - Potable AWSS		2,000,000	10,000,000	10,450,000	10,920,300	11,411,700	-	-	-	-	-	69	-	44,782,000	44,782,000
70	Automated Water Meter Program	565,733	1,800,000	-	-	-	-	-	-	-	-	-	70	1,000,000	1,800,000	800,000
71	Other Recycled Water Projects - Local	6,146,515	-	-	700,000	-	-	-	-	-	-	-	71	-	700,000	700,000
72	520 John Muir Drive - Site Rehabilitation	7,584,005	2,441,000	-	-	-	-	-	-	-	-	-	72	-	2,441,000	2,441,000
73	Systems Monitoring & Control	6,410,161	200,000	209,000	218,400	228,200	238,500	249,200	260,400	272,100	284,300	297,200	73	8,000,000	2,457,300	(5,542,700)
74	Local Tanks/Reservoir Improvements	2,459,712	10,100,000	3,000,000	300,000	200,000	-	-	-	-	-	-	74	7,500,000	13,600,000	6,100,000
75	Pump Station Improvements	2,534,105	932,000	2,250,000	17,500,000	600,000	-	-	-	-	-	-	75	17,500,000	21,282,000	3,782,000
76	SF Westside Recycled Water (Non WSIP)	140,207,441	6,500,000	500,000	-	-	-	-	-	-	-	-	76	13,272,000	7,000,000	(6,272,000)
77	Buildings and Grounds Improvements - Local	4,484,310	260,000	200,000	-	-	-	-	-	-	-	-	77	20,525,000	460,000	(20,065,000)
78	New Service Connection Improvement Program - NEW		968,000	1,377,000	645,000	-	-	-	-	-	-	-	78	-	2,990,000	2,990,000
79	Town of Sunol Pipeline - NEW		2,700,000	700,000	-	-	-	-	-	-	-	-	79	-	3,400,000	3,400,000
80	Lombard Geotechnical Improvements - NEW		75,000	175,000	2,000,000	-	-	-	-	-	-	-	80	-	2,250,000	2,250,000
81	Additional Newcomb Yard Improvements - NEW		-	-	1,000,000	13,000,000	26,000,000	-	-	-	-	-	81	-	40,000,000	40,000,000
82	**Subtotal**	**228,908,229**	**84,076,000**	**74,511,000**	**89,813,400**	**82,948,500**	**96,650,200**	**60,249,200**	**61,260,400**	**62,272,100**	**64,284,300**	**67,597,200**	82	**628,797,000**	743,662,300	**114,865,300**
83	**Auxiliary Water Supply System**												83			
84	ESER 2020	-	-	-	50,000,000	40,000,000	-	-	-	-	-	-	84	110,000,000	90,000,000	(20,000,000)
85	**Subtotal**	-	-	-	**50,000,000**	**40,000,000**	-	-	-	-	-	-	85	**110,000,000**	90,000,000	**(20,000,000)**
86													86		-	
87	**LOCAL WATER TOTAL**	**228,908,229**	**84,076,000**	**74,511,000**	**139,813,400**	**122,948,500**	**96,650,200**	**60,249,200**	**61,260,400**	**62,272,100**	**64,284,300**	**67,597,200**	87	**738,797,000**	833,662,300	**94,865,300**
88													88		-	
89	**TOTAL USES**	**378,365,051**	**264,349,000**	**187,715,000**	**321,451,400**	**189,319,500**	**160,228,200**	**127,290,200**	**117,659,400**	**114,633,100**	**114,746,300**	**129,319,200**	89	**1,316,893,000**	**1,726,711,300**	**409,818,300**
90													90			
91	SOURCES		FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	91	FY 18-27	FY 19-28	Change
92	**Debt**												92			
93	Regional Bonds - Wholesale Only		-	-	-	-	3,000,000	4,000,000	5,000,000	10,000,000	8,000,000	20,000,000	93	-	50,000,000	50,000,000
94	Regional Bonds		128,469,000	61,400,000	170,267,000	54,994,000	49,201,000	51,308,000	28,997,000	10,526,000	13,377,000	21,722,000	94	313,863,000	590,261,000	276,398,000
95	General Obligation Bonds - ESER 2020 & Beyond		-	-	50,000,000	40,000,000	-	-	-	-	-	-	95	110,000,000	90,000,000	(20,000,000)
96	Local Bonds		82,309,000	73,000,000	60,659,400	44,328,500	53,030,200	11,629,200	7,640,400	3,652,100	24,159,300	35,953,200	96	298,597,000	396,361,300	97,764,300
97	**Subtotal**		**210,778,000**	**134,400,000**	**280,926,400**	**139,322,500**	**105,231,200**	**66,937,200**	**41,637,400**	**24,178,100**	**45,536,300**	**77,675,200**	97	**722,460,000**	**1,126,622,300**	**404,162,300**
98	**Other**												98			
99	Capacity Fee		1,767,000	1,511,000	1,554,000	1,520,000	1,520,000	1,520,000	1,520,000	1,520,000	1,580,000	1,644,000	99	10,000,000	15,656,000	5,656,000
100	**Subtotal**		**1,767,000**	**1,511,000**	**1,554,000**	**1,520,000**	**1,520,000**	**1,520,000**	**1,520,000**	**1,520,000**	**1,580,000**	**1,644,000**	100	**10,000,000**	**15,656,000**	**5,656,000**
101	**Revenue**												101			
102	Local Revenue		-	-	27,600,000	37,100,000	42,100,000	47,100,000	52,100,000	57,100,000	38,545,000	30,000,000	102	331,645,000	331,645,000	-
103	Regional Revenue		51,804,000	51,804,000	11,371,000	11,377,000	11,377,000	11,733,000	22,402,000	31,835,000	29,085,000	20,000,000	103	252,788,000	252,788,000	-
104	**Subtotal**		**51,804,000**	**51,804,000**	**38,971,000**	**48,477,000**	**53,477,000**	**58,833,000**	**74,502,000**	**88,935,000**	**67,630,000**	**50,000,000**	104	**584,433,000**	**584,433,000**	-
105													105			
106	**Total SOURCES**		**264,349,000**	**187,715,000**	**321,451,400**	**189,319,500**	**160,228,200**	**127,290,200**	**117,659,400**	**114,633,100**	**114,746,300**	**129,319,200**	106	**1,316,893,000**	**1,726,711,300**	**409,818,300**
107													107			
108	Surplus / (Shortfall)		-	-	-	-	-	-	-	-	-	-	108	-	-	-
109													109			
110	Projects with funding reduced or funding eliminated and candidates not recommended for funding		FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	110	FY 18-27	FY 19-28	Change
111	**Regional Water**												111			
112	**Water Supply and Storage Program**												112			
113	San Antonio Pipeline PCCP Replacement		500,000	500,000	3,000,000	3,000,000	20,900,000	20,900,000	-	-	-	-	113	-	48,800,000	48,800,000
114	CSPL3 PCCP Replacement		-	-	-	-	-	-	20,000,000	20,000,000	20,000,000	-	114	-	60,000,000	60,000,000
115	Bay Area Watershed and ROW Protection Program		2,700,000	1,773,000	3,324,000	1,925,000	2,004,000	2,085,000	2,168,000	2,254,000	2,341,000	2,432,000	115	-	23,006,000	23,006,000
116	Attractive Nuisance Facilities		2,500,000	2,500,000	3,000,000	9,500,000	43,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	116	-	65,500,000	65,500,000
117			**5,700,000**	**4,773,000**	**9,324,000**	**14,425,000**	**65,904,000**	**23,985,000**	**23,168,000**	**23,254,000**	**23,341,000**	**3,432,000**	117	-	**197,306,000**	197,306,000
118													118			
119	**Local Water**												119			
120	Automated Water Meter Program		-	-	-	-	-	500,000	10,000,000	10,000,000	10,000,000	-	120	-	30,500,000	30,500,000
121	Additional Newcomb Yard Improvements		-	-	-	-	-	5,000,000	25,000,000	25,000,000	-	-	121	-	55,000,000	55,000,000
122			-	-	-	-	-	**5,500,000**	**35,000,000**	**35,000,000**	**10,000,000**	-	122	-	**85,500,000**	85,500,000

	A	B	C	D	E	F	G	H	I	J	K	L		M	N	O
1	USES	Available Balance as of 6/30/2017	FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	1	FY 18-27	FY 19-28	Change
2	Watershed Protection	874,107	600,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	2	5,000,000	5,100,000	100,000
3	WSIP-Related Mitigation & Monitoring	1,194,185	6,585,000	11,201,000	12,219,000	12,761,000	10,440,000	11,426,000	13,967,000	14,330,000	14,643,000	14,834,000	3	46,065,000	122,406,000	76,341,000
4	Watershed Structures Upgrades	590,167	1,196,000	1,196,000	1,196,000	1,196,000	1,196,000	1,196,000	1,196,000	1,196,000	1,196,000	1,196,000	4	7,187,000	11,960,000	4,773,000
5	Landscape Conservation Program	5,804,405	2,000,000	2,000,000	1,000,000	-	-	-	-	-	-	-	5	8,000,000	5,000,000	(3,000,000)
6	AWSS Maintenance	220,081	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	6	7,750,000	5,000,000	(2,750,000)
7	Water Resource Planning and Development	2,234,651	300,000	300,000	300,000	300,000	300,000	-	-	-	-	-	7	1,500,000	1,500,000	0
8	Treasure Island Facilities Maintenance	93,382	1,273,000	1,311,000	1,350,000	1,390,000	1,431,000	1,474,000	1,518,000	1,560,000	1,600,000	1,650,000	8	10,665,000	14,557,000	3,892,000
9	Retrofit Grant Program	4,070,000	1,134,000	637,000	257,000	488,000	507,000	435,000	-	-	-	-	9	4,810,000	3,458,000	(1,352,000)
10	Youth Employment Project	-	1,290,000	1,290,000	1,290,000	1,290,000	1,290,000	1,290,000	1,290,000	1,290,000	1,290,000	1,290,000	10	12,900,000	12,900,000	0
11	Community Benefits-Water	740,366	-	-	-	-	-	-	-	-	-	-	11	1,650,000	-	(1,650,000)
12	**Subtotal**	15,821,344	**14,878,000**	**18,935,000**	**18,612,000**	**18,425,000**	**16,164,000**	**16,821,000**	**18,971,000**	**19,376,000**	**19,729,000**	**19,970,000**	12	**105,527,000**	**181,881,000**	**76,354,000**
13	**525 Golden Gate**												13			
14	525 Golden Gate - Operations and Maintenance	141,170	5,277,000	4,050,000	4,064,000	4,186,000	4,311,000	4,441,000	4,575,000	4,710,000	4,851,000	4,995,000	14	41,392,000	45,460,000	4,068,000
15	525 Golden Gate - Lease Payment	2,719,323	9,168,000	9,169,000	9,169,000	9,167,000	9,169,000	9,131,000	9,055,000	8,975,000	8,895,000	8,812,000	15	91,570,000	90,710,000	(860,000)
16	**Subtotal**	2,860,493	**14,445,000**	**13,219,000**	**13,233,000**	**13,353,000**	**13,480,000**	**13,572,000**	**13,630,000**	**13,685,000**	**13,746,000**	**13,807,000**	16	**132,962,000**	**136,170,000**	**3,208,000**
17													17			
18	**Total USES**	**18,681,837**	**29,323,000**	**32,154,000**	**31,845,000**	**31,778,000**	**29,644,000**	**30,393,000**	**32,601,000**	**33,061,000**	**33,475,000**	**33,777,000**	18	**238,489,000**	**318,051,000**	**79,562,000**
19													19			
20													20			
21	SOURCES		FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	21	FY 18-27	FY 19-28	Change
22	Other												22			
23	Infrastructure - Recovery Capital (O&M)		1,477,000	1,134,000	1,142,000	1,176,000	1,211,000	1,248,000	1,248,000	1,248,000	1,285,000	1,324,000	23	11,521,000	12,493,000	972,000
24	Federal Bond Interest Subsidy		1,951,000	1,951,000	1,945,000	1,954,000	1,945,000	1,910,000	1,942,000	1,770,000	1,695,000	1,616,000	24	18,480,000	18,679,000	199,000
25	Infrastructure - Recovery Capital (Lease)		2,650,000	2,650,000	2,650,000	2,650,000	2,650,000	2,650,000	2,650,000	2,650,000	2,650,000	2,650,000	25	26,500,000	26,500,000	-
26	**Subtotal**		**6,078,000**	**5,735,000**	**5,737,000**	**5,780,000**	**5,806,000**	**5,808,000**	**5,840,000**	**5,668,000**	**5,630,000**	**5,590,000**	26	**56,501,000**	**57,672,000**	**1,171,000**
27	Revenue												27			
28	Revenue		23,245,000	26,419,000	26,108,000	25,998,000	23,838,000	24,585,000	26,761,000	27,393,000	27,845,000	28,187,000	28	181,988,000	260,379,000	
29	**Subtotal**		**23,245,000**	**26,419,000**	**26,108,000**	**25,998,000**	**23,838,000**	**24,585,000**	**26,761,000**	**27,393,000**	**27,845,000**	**28,187,000**	29	**181,988,000**	**260,379,000**	**78,391,000**
30													30			
31	**Total SOURCES**		**29,323,000**	**32,154,000**	**31,845,000**	**31,778,000**	**29,644,000**	**30,393,000**	**32,601,000**	**33,061,000**	**33,475,000**	**33,777,000**	31	**238,489,000**	**318,051,000**	**79,562,000**
32													32			
33	Surplus / (Shortfall)		-	-	-	-	-	-	-	-	-	-	33	-	-	-

Water Enterprise

Fiscal Year 2019-2028

Ten Year CIP

January 18, 2018

Project FAMIS#:	CUW2720101
Project Title:	Regional Water - Tesla UV Facility - CUW2720101
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Chris Nelson
Asset Classification:	Water Treatment Program
Type:	Capital
Description:	Expenditures in this project consist of minor upgrades to the Tesla UV Facility to achieve a higher level of performance. Projects include upgrades of chemical dosage, flow monitoring, small valve and pump replacement, chemical handling upgrades,and building ventilation (just building ventilation redesign will cost $2M).
Justification:	Many of the projects are identified at the startup of the UV facility and by Operations staff observations. The project will result in more reliable performance.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 2,046	$ 200	$ 200	$ 200	$ 200	$ 200	$ 1,046
Construction Management	$ 2,083	$ 1,000	$ 1,000	$ 8	$ 8	$ 8	$ 59
Construction	$ 787	$ 72	$ 72	$ 72	$ 72	$ 72	$ 427
Total	**$ 4,916**	**$ 1,272**	**$ 1,272**	**$ 280**	**$ 280**	**$ 280**	**$ 1,532**

Project FAMIS#:	CUW2720202
Project Title:	Regional Water - SVWTP & East Bay Fields - CUW2720202
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Chris Nelson
Asset Classification:	Water Treatment Program
Type:	Capital
Description:	Expenditures in this project consist of major upgrades to Sunol Valley Water Treatment Plant (SVWTP) to achieve a higher level of performance. The budget for this project includes the expected replacement of worn plant components such as lighting at the filter basin area, fire protection in the ITS/SCADA server room, cationic polymer piping, chemical feed discharge lines at the hypo and alum chemical skids, chemical control panel removal and chemical tank level control panel consolidation, centralized HVAC control system, modifications to existing vaults to minimize confined space entry to critical valves, main UPS circuit identification and consolidation, dayroom remodel, Operations control center, inner electric gate to conform to security requirements, 48" flocculator drives and controllers, wash water tank discharge valve electrical actuator, and main switchgear power monitoring installation. Work also continues to provide polymer feed to the new Basin 5, along with Basins 1-4. Taste and Odor issues from December 2016 also adds $85M to add PAC and Ozone in preparation for the consecutive 100 day shutdowns starting in 2020. This program funds various treatment plant improvement projects: 1. SVWTP SCADA Server Room - The scope of this project includes moving a makeshift SCADA server room to a nearby storage room, upgrading the air conditioning equipment, and making other related upgrades. 2. SVWTP Basin 5 Optimization - The scope of this project includes installation of a new polymer feed facility for SVWTP Basins 1 through 5. WSTD is funding costs beyond $2.17M. The WSIP funding for this project is lumped together with other Sunol Valley closeout projects. 3. Nominal SVWTP and East Bay capital costs annually. 4. Calaveras Reservoir Circulation System ($600K)
Justification:	Many of the projects are identified through condition assessments, operations staff observations, review of level of service, subsequent feasibility studies, and alternative analyses at each major plant. The project will result in more reliable performance.
Operating Impact:	This project ensures reliability and overall treatment efficiency of the SVWTP.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 95	$ 95	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 30	$ 30	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 129	$ 129	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 525	$ 525	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 9,054	$ 2,254	$ 3,550	$ 700	$ 450	$ 350	$ 1,750
Total	**$ 9,833**	**$ 3,033**	**$ 3,550**	**$ 700**	**$ 450**	**$ 350**	**$ 1,750**

Project FAMIS#:	CUW2720301
Project Title:	Regional Water - HTWTP & West Bay Fields - CUW2720301
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Chris Nelson
Asset Classification:	Water Treatment Program
Type:	Capital
Description:	Expenditures in this program consists of upgrades to Harry Tracy Water Treatment Plant (HTWTP) to achieve a higher level of performance, all West Bay Field facility improvements, and Water Quality sample stations in the West Bay. Projects include upgrades of chemical dosage, flow monitoring, valve and pump replacement, and chemical handling upgrades.
Justification:	Many of the projects are identified through condition assessments, operations staff observations, review of level of service and subsequent feasibility studies and alternative analyses at each major facility.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 844	$ 80	$ 80	$ 80	$ 80	$ 80	$ 444
Construction	$ 12,791	$ 2,134	$ 1,141	$ 1,148	$ 1,154	$ 1,154	$ 6,060
Total	**$ 13,635**	**$ 2,214**	**$ 1,221**	**$ 1,228**	**$ 1,234**	**$ 1,234**	**$ 6,504**

Project FAMIS#:	CUW2720210
Project Title:	Regional Water - SVWTP Ozone - NEW - CUW2720210
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	David Quinones
Asset Classification:	Water Treatment Program
Type:	Capital
Description:	The scope includes installation of ozone generators, ozone contactors, and other related upgrades in order to minimize taste and odor from the treated water coming out of SVWTP. This project addresses long term taste and odor control associated with algal blooms in San Antonio and Calaveras Resevoirs.
Justification:	This project resulted from taste and odor outbreaks associated with algal blooms in San Antonio and Calaveras Reservoirs.
Operating Impact:	This project will improve the water quality especially during warm months and during Hetch Hetchy shutdowns.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 1,600	$ 1,100	$ 500	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 1,000	$ 500	$ 500	$ 0	$ 0	$ 0	$ 0
Design	$ 9,400	$ 2,400	$ 7,000	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 3,000	$ 0	$ 0	$ 3,000	$ 0	$ 0	$ 0
Construction	$ 100,000	$ 0	$ 0	$ 100,000	$ 0	$ 0	$ 0
Total	**$ 115,000**	**$ 4,000**	**$ 8,000**	**$ 103,000**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW2720209
Project Title:	Regional Water - SVWTP Power Activated Carbon Units - NEW - CUW2720209
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	David Quinones
Asset Classification:	Water Treatment Program
Type:	Capital
Description:	The scope includes installation of a pair of concrete PAC tanks, the associated chemical feed system, and other related upgrades in order to minimize taste and odor from the treated water coming out of SVWTP. This project took over the previous SVWTP Phase 3 Project.
Justification:	This project resulted from taste and odor outbreaks associated with algal bloom in San Antonio and Calaveras Reservoirs.
Operating Impact:	This project will improve the water quality especially during warm months and during Hetch Hetchy shutdowns.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 4,720	$ 4,000	$ 440	$ 280	$ 0	$ 0	$ 0
Construction	$ 745	$ 745	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 5,465**	**$ 4,745**	**$ 440**	**$ 280**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW2720304
Project Title:	Regional Water - Reg. GW Storage and Recovery Project (Post WSIP) - NEW - CUW2720304
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Chris Nelson
Asset Classification:	Water Treatment Program
Type:	Capital
Description:	The Regional Groundwater Storage and Recovery Project is provided in response to the Water Supply LOS goal. The purpose of the project is to develop a Regional Water System groundwater supply in the South Westside Basin for use during dry years. In normal and wet years, the SFPUC will supply supplemental surface water to Daly City, San Bruno, and Cal Water to be used in place of their typical groundwater pumping. The reduced pumping during normal and wet years will thereby increase the volume of groundwater in storage that can be pumped as supplemental water in dry years. The wells are in the South Westside Groundwater Basin (Daly City, Colma, South San Francisco, San Bruno, and Millbrae) and will be used to supply supplemental water during dry years. There are a total of 15 wells in the area extending from the Millbrae Yard to the Lake Merced Golf Club.
Justification:	None
Operating Impact:	Recovery of stored water will be delayed until construction is complete in 2019. Costs below reflect post construction costs.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 500	$ 50	$ 50	$ 50	$ 50	$ 50	$ 250
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 500**	**$ 50**	**$ 50**	**$ 50**	**$ 50**	**$ 50**	**$ 250**

Project FAMIS#:	CUW27301
Project Title:	Regional Water - Corrosion Protection Capital Upgrades - CUW27301
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Jonathan Chow
Asset Classification:	Water Transmission Program
Type:	Capital
Description:	Appropriate corrosion control is essential to extending the life of buried structures such as pipelines. The program consists of installing testing stations, galvanic and impressed current systems, remote monitoring units, and installation of isolation protection systems for priority assets. The program also provides funding for maintenance of existing systems such as rectifier repairs and sacrificial anode replacements, active systems with impressed current, isolating structures, and enhanced monitoring.
Justification:	A Corrosion Planning Report was completed in 1999. A master plan identified specific projects and costs and was completed in August 2010. Investments in corrosion protection are a cost effective way to significantly extend the usable life of pipelines and appurtenances.
Operating Impact:	The project increases operating expenditures by about $10K per year for activities related to managing corrosion data and monitoring systems that are performed by consultants (professional services).

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 3,725	$ 350	$ 375	$ 375	$ 375	$ 375	$ 1,875
Environmental Review	$ 265	$ 40	$ 25	$ 25	$ 25	$ 25	$ 125
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 820	$ 160	$ 160	$ 100	$ 75	$ 75	$ 250
Construction	$ 15,540	$ 2,200	$ 3,500	$ 1,440	$ 1,000	$ 1,000	$ 6,400
Total	**$ 20,350**	**$ 2,750**	**$ 4,060**	**$ 1,940**	**$ 1,475**	**$ 1,475**	**$ 8,650**

Project FAMIS#:	CUW2730200
Project Title:	Regional Water - Pipeline Inspection and Repair Project - CUW2730200
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Jonathan Chow
Asset Classification:	Water Transmission Program
Type:	Capital
Description:	This project funds inspection (including shutting down, de-watering, and disinfection of pipelines) and minor rehabilitation and repair of pipelines that follow these inspections. Repairs can usually be made in weeks or within one to two months. Appurtenances such as blow-off valves and air valves are replaced and often times mortar lining or polyurethane lining can be repaired in short stretches. Inspections expected in FY2019 include SA2 (R60 to CDD), CS Bypass Pipeline, Balancing Rservoir Pipeline, BDPL4 (D30 to D40), BDPL3 (C30 to C70), and Irvington Tunnel No.2. An available 20-Year Pipeline Inspection Schedule outlined inspections for the next 20 years. In general, inspections are not committed to more than 1 year in advance. Specific known repairs include approximately 10,000 linear feet of damaged mortar on Bay Division No. 4, which was documented during an inspection in 2010. Due to the scale of repair ($2M), this scope and funding will be shifted to the Pipeline Improvement Program. For budgetary estimate, each pipeline shutdown, de-watering, and disinfection cost about $250K. Inpsection of Irvington Tunnel No.2 requires removal of portal protection structure and bringing in specialized inspection ROV, budgetary cost $1M Electromagnetic Inspection of PCCP, $30K/mob, $25K/mi, $10k/report
Justification:	Periodic internal pipeline inspections are essential to minimize pipeline failures. It also provides a condition assessment of our pipelines, which provides a basis for prioritizing pipeline replacements. Routine pipeline inspections are a part of good industry maintenance practice for large diameter transmission pipelines. Pipelines are inspected based on a long-term schedule that is updated each year by the Principal Engineer. First, a long-range recurrence inspection schedule is created based on the elapsed time since the last inspection, the condition of the pipe found on the previous inspection, and pipe material. Second, these schedules are adjusted by up to two years (forward or back in time) to accommodate construction and other system outages that can affect the cost of performing the shutdown and inspection. Third, the criticality of the pipeline is considered, particularly if a segment of pipe will be relied upon with no redundancy during other outages. If a pipeline is particularly critical, other factors carry less weight.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 2,970	$ 360	$ 360	$ 360	$ 270	$ 270	$ 1,350
Environmental Review	$ 100	$ 100	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 1,580	$ 200	$ 200	$ 200	$ 140	$ 140	$ 700
Construction Management	$ 1,360	$ 200	$ 160	$ 160	$ 120	$ 120	$ 600
Construction	$ 12,610	$ 2,600	$ 1,400	$ 1,400	$ 1,030	$ 1,030	$ 5,150
Total	**$ 18,620**	**$ 3,460**	**$ 2,120**	**$ 2,120**	**$ 1,560**	**$ 1,560**	**$ 7,800**

Project FAMIS#:	CUW2730401
Project Title:	Regional Water - Pump Station Upgrades - CUW2730401
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Chris Nelson
Asset Classification:	Water Transmission Program
Type:	Capital
Description:	Program would fund minor to medium sized overhauls of existing pump stations such as San Antonio Pump Station (SAPS) diesel pump replacement and electrical upgrades, MCCs, protective relays, and load tap changers. Parts at the Calaveras Substation and SAPS, is being considered here. Also consider rehabilitating the old Crystal Springs Pump Station by removing abandoned equipment and turning it into usable storage space. This program funds various pump station improvement projects: 1. Electrical Upgrades - Update arc flash/fault current analyses for all WSTD facilities. 2. SAPS MCC Replacement - Replacement of the SAPS MCCs & communication equipment and structural upgrades to 3 rooms. 3. Replace diesels at SAPS with electrics. Upgrade backup power accordingly (FY24 and FY25). 4. Upgrade Calaveras Substation related to SAPS and SVWTP upgrades. 5. Repurpose Crystal Springs Pump Station
Justification:	Based on recently completed condition assessments and required performance of the major pump stations within the Regional Water System, and the scope of work not included in WSIP, about $45M is required to maintain level of service post WSIP.
Operating Impact:	More efficient pumps will lower operating costs by $30K per year.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 836	$ 30	$ 30	$ 30	$ 530	$ 30	$ 186
Environmental Review	$ 1,537	$ 50	$ 50	$ 50	$ 1,050	$ 50	$ 287
Design	$ 3,553	$ 100	$ 100	$ 100	$ 100	$ 2,600	$ 553
Construction Management	$ 1,053	$ 100	$ 100	$ 100	$ 100	$ 100	$ 553
Construction	$ 38,320	$ 900	$ 3,400	$ 1,900	$ 1,500	$ 900	$ 29,720
Total	**$ 45,299**	**$ 1,180**	**$ 3,680**	**$ 2,180**	**$ 3,280**	**$ 3,680**	**$ 31,299**

Project FAMIS#:	CUW2730501
Project Title:	Regional Water - Pipeline Improvement Program - CUW2730501
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Annie Li
Asset Classification:	Water Transmission Program
Type:	Capital
Description:	This program funds various pipeline improvement projects: 1. SVWTP 78" Effluent Pipeline repair/improvements along fault crossings in the Sunol Valley in later years of CIP, helps with LCA/MT reliability. $2.5M 2. Calaveras Pipeline repair/improvements along fault crossing in the Sunol Valley in later years of CIP, helps with LCA/MT reliability. $2.5M 3. San Antonio Pipeline (SAPL) Replacement (2 mi) - rehab, repair, replacement of 60" PCCP that transmit water in/out of San Antonio Reservoir. SAPL exhibits leaks and failures in the past, being PCCP and the only pipeline that gets water in/out of reservoir, it should be replaced, helps with LCA/MT reliability. $48.8M 4. Alameda Siphons 1, 2, and 3 are currently exposed crossing Alameda Creek due to erosion ($6M in FY 26-28) 5. BD4B lining repair, planning and design in FY19-20, construction in FY 21. $2M 6. BD4D PCCP repair, segment of concentrated distressed PCCP re-lined with carbon fiber liner, construction in FY19. $5.5M. Other sections of BD 4D will need to be addressed (currently unfunded). 7. Slurry abandoned CS1 (14 mi), on-going in later years of CIP. $3.7 M 8. CS2 replacement K10 to K30 (4 mi) - re-alignment, repair/replacement alternatives in FY17/18, design FY18/19, construction FY20. Move air gap to CSBT location (eliminate 1 mile of dead-end potable transmission pipe). The remaining work for this pipeline will continue in the out years. $56M 9. CS2 replacement K40 to K50 (4 mi) - lining replacement, add new manholes and isolation valves, design FY17/18, construction FY19. $13M 10. SF Jail Waterline Replacement - replacement of 5.2 miles of 90 years old 10" CI pipeline with leaded joints. Planning and design in FY19 - 21, construction in FY22. $21.6M 11. SA2 (HTWTP to R20) - $3M, Replace or slip-line up to 2 miles starting from HTWTP and working downstream. Award construction contract in FY18, $3M contingency fund for PCO in FY19 12. PPSU Phase 3 - $500K, construction of the seismic upgrades on SAPL2 are currently underway, expecting to closeout contract in FY19 13. CSPL 3 Replace or slip-lining up to 10 miles of pipeline in densely populated areas where prestressed concrete cylinder pipe (PCCP) is present, at later years in CIP ($60M in FY26-28). 14. Enhanced WQ instrumentation, add two sites with instrumentation packages, SCADA equipped. 15. Replacement of 5.1 miles of 36" Palo Alto Pipeline in later years of CIP ($90M in FY23-27)
Justification:	PCCP Reliability Enhancement Program (2003) and BDPL4A & D Condition Assessment (2008) are two reports that point to the significance of monitoring, strengthening, and replacing these types of pipes as needed in order to maintain reliability. Unlike welded steel pipe failures which are typically corrosion leaks from a small hole in the pipeline, PCCP generally fails catastrophically with an explosion in the concrete creating a river of water coming out of a large hole in the concrete pipe.
Operating Impact:	Different sections of pipelines going out of service for inspection and construction must be carefully coordinated in order to maintain customer supply.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 1,000	$ 0	$ 0	$ 0	$ 0	$ 0	$ 1,000
Environmental Review	$ 1,000	$ 0	$ 0	$ 0	$ 0	$ 0	$ 1,000
Design	$ 1,000	$ 0	$ 0	$ 0	$ 0	$ 0	$ 1,000
Construction Management	$ 1,000	$ 0	$ 0	$ 0	$ 0	$ 0	$ 1,000
Construction	$ 34,800	$ 22,250	$ 900	$ 1,150	$ 500	$ 500	$ 9,500
Total	**$ 38,800**	**$ 22,250**	**$ 900**	**$ 1,150**	**$ 500**	**$ 500**	**$ 13,500**

SFPUC Capital Project Plan
Water Enterprise
Regional Water

Project FAMIS#:	CUW2730509
Project Title:	Regional Water - CS2 in Hillsborough Improvements (Reaches 2 & 3) - CUW2730509
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Janet Ng
Asset Classification:	Water Transmission Program
Type:	Capital
Description:	The Crystal Springs Pipeline No. 2 (CSPL2) is part of the SFPUC Regional Water System, which starts at Crystal Springs Reservoir and terminates at University Mound Reservoir. This project will rehabilitate Reaches 2 and 3, approximately 3.75 miles, in the Town of Hillsborough that have been identified to be at risk for failure due to their proximity to Polhemus Creek and maintenance issues that need to be addressed.
Justification:	Approximately 4,800 feet of Reach 2 of CSPL2 have been identified to be at risk for failure due to its proximity to Polhemus Creek and alignment on an eroding slope. In addition, Reaches 2 and 3 have lining failures that are causing taste and odor issues which need to be addressed.
Operating Impact:	This project will reduce the risk of Reach 2 failing and discharging into Polhemus Creek and improve the quality of the water transported from Crystal Springs Reservoir to University Mound Reservoir in Reaches 2 and 3.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 56,000	$ 1,750	$ 27,120	$ 27,130	$ 0	$ 0	$ 0
Total	**$ 56,000**	**$ 1,750**	**$ 27,120**	**$ 27,130**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW2730515
Project Title:	Regional Water - Palo Alto Pipeline Replacement - CUW2730515
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Annie Li
Asset Classification:	Water Transmission Program
Type:	Capital
Description:	Replacement of 5.1 miles of 36" Palo Alto Pipeline in later years of CIP ($90M in FY23-27).
Justification:	Palo Alto Pipeline has exhibited many leaks along the pipeline that created temporary service disruption to the customers.
Operating Impact:	Leaks have created temporary service disruption to the customers.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 90,000	$ 0	$ 0	$ 0	$ 0	$ 3,000	$ 87,000
Total	**$ 90,000**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 3,000**	**$ 87,000**

SFPUC Capital Project Plan
Water Enterprise
Regional Water

Project FAMIS#:	CUW2730601
Project Title:	Regional Water - Valve Replacement - CUW2730601
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Chris Nelson
Asset Classification:	Water Transmission Program
Type:	Capital
Description:	This project replaces aging line valves, air valves, blow-offs, and other pipeline appurtenances not already replaced as part of WSIP and which present cross-connection problems associated with new infrastructure. Includes structural improvements of valve vaults, as required. Also includes Regional upgrades (motivated by March 3, 2015 incident).
Justification:	Expenditures are required to maintain transmission system reliability and redundancy.
Operating Impact:	The project reduces miscellaneous repairs needed within the Regional Water System.

All values in $1,000	**2019-2028**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024-2028**
Planning	$ 1,548	$ 400	$ 200	$ 150	$ 150	$ 100	$ 548
Environmental Review	$ 1,033	$ 350	$ 150	$ 100	$ 100	$ 50	$ 283
Design	$ 3,076	$ 700	$ 700	$ 200	$ 200	$ 200	$ 1,076
Construction Management	$ 2,050	$ 350	$ 350	$ 350	$ 350	$ 100	$ 550
Construction	$ 21,222	$ 5,900	$ 4,900	$ 3,900	$ 900	$ 900	$ 4,722
Total	**$ 28,929**	**$ 7,700**	**$ 6,300**	**$ 4,700**	**$ 1,700**	**$ 1,350**	**$ 7,179**

Project FAMIS#:	CUW2730701
Project Title:	Regional Water - Vault Upgrades - CUW2730701
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Chris Nelson
Asset Classification:	Water Transmission Program
Type:	Capital
Description:	This project replaces and/or upgrades various vaults within the regional transmission system. Typical upgrades include SCADA installation/upgrades, actuator replacement/electrical upgrades, sump pump replacement, and access improvements and other OSHA-driven safety improvements.
Justification:	Expenditures are required to maintain transmission system reliability and redundancy.
Operating Impact:	The project reduces miscellaneous repairs needed within the regional transmission system.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 524	$ 50	$ 50	$ 50	$ 50	$ 50	$ 274
Environmental Review	$ 273	$ 25	$ 25	$ 25	$ 25	$ 25	$ 148
Design	$ 1,044	$ 100	$ 100	$ 100	$ 100	$ 100	$ 544
Construction Management	$ 520	$ 50	$ 50	$ 50	$ 50	$ 50	$ 270
Construction	$ 4,662	$ 450	$ 450	$ 450	$ 450	$ 450	$ 2,412
Total	**$ 7,023**	**$ 675**	**$ 675**	**$ 675**	**$ 675**	**$ 675**	**$ 3,648**

Project FAMIS#:	CUW2730901
Project Title:	Regional Water - Metering Upgrades - CUW2730901
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Annie Li
Asset Classification:	Water Transmission Program
Type:	Capital
Description:	This project is to ensure accurate water accounting by maintaining various water meters in the Regional Water System to provide realible and precise reads. Upcoming projects include: New Sunset Supply Meter to capture flow to Sunset & Sutro Reservoirs crossing the county-line. This is one of the more expensive installation work on meters. San Antonio Forward/Reverse meter, modify vault hatch for easier access and restore sump pump. Albers Road venturi meters upgrade to include HMI local display at RTU. New effluent meter (accusonic) needs to develop flow verification procedures with BAWSCA. SA-3 meter, potential to use new CDD installed meter at Merced Manor to be the new county-line meter. SA-2 meter, retrofit to for reverse flow detection BDPL 1-5 meters at Pulgas Valve Lot, retrofit to read low flow conditions. Update as-built at each of the meter site to reflect most current installation.
Justification:	Accurate flow measurement is needed for system input and deliveries in real time for day-to-day management of the Regional Water System and for water use report generation.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 2,082	$ 200	$ 200	$ 200	$ 200	$ 200	$ 1,082
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 2,082**	**$ 200**	**$ 200**	**$ 200**	**$ 200**	**$ 200**	**$ 1,082**

Project FAMIS#:	CUW27603_N01
Project Title:	Regional Water - BDPL 1 & 2 Decommissioning - NEW - CUW27603_N01
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Bryan Dessaure
Asset Classification:	Water Transmission Program
Type:	Capital
Description:	Since the completion and warranty inspection of the Bay Division Pipelines Reliability Upgrade-Tunnel (aka "Bay Tunnel") in 2016, existing Bay Division Pipelines 1 and 2 ("BDPL 1 and 2") crossing the Bay at Dumbarton are no longer in use for water transmission. A memorandum to the Commission dated February 6, 2017 reviewed decommissioning options, and a follow-up memorandum to the Commission dated December 29, 2017 considered alternative productive uses of BDPL 1 and 2. In accordance with the conclusions of these two memoranda, this project is to pursue partial removal of the pipelines and wood trestles to the mudline within the Don Edwards San Francisco Bay Wildlife Refuge (Wildlife Refuge). The proposed level of funding allows for planning, environmental review/permitting and 35% plans, and includes a task to seek potential funding sources to complete detailed plans and construction, including grant(s) that may be available to help fund the project. The planning portion of the proposed funding assumes that the project would go directly to a Conceptual Engineering Report (CER), with no Alternatives Analysis Report (AAR) required.
Justification:	Environmental toxicity testing of the existing BDPL 1 and 2 shows that the exterior pipe coating and wood trestles are a potential long-term concern to the environment, especially within the Wildlife Refuge. Furthermore, reuse of BDPL 1 and 2 for other utility purposes raises considerable financial, operating and environmental concerns. The capital and operating costs to upgrade and maintain the pipelines for an alternative use would be significant, and perhaps more costly than partial removal of the decommissioned pipelines over the long term.
Operating Impact:	Since the BDPL 1 and 2 are no longer in use, partial removal within the Wildlife Refuge would not have any operational impact on water delivery reliability.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 1,000	$ 0	$ 0	$ 1,000	$ 0	$ 0	$ 0
Environmental Review	$ 2,250	$ 0	$ 0	$ 1,250	$ 1,000	$ 0	$ 0
Design	$ 1,250	$ 0	$ 0	$ 0	$ 1,250	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 4,500**	**$ 0**	**$ 0**	**$ 2,250**	**$ 2,250**	**$ 0**	**$ 0**

Project FAMIS#:	CUW2740101
Project Title:	Regional Water - Dam Structural Upgrades (w/ geotech) - CUW2740101
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Stacie Feng
Asset Classification:	Water Supply and Storage Program
Type:	Capital
Description:	This dam safety program covers stability study of dams and ancillary structures, condition assessment of spillways, instrumentation upgrades, repairs and maintenance, and capital improvement projects at San Andreas Dam, Pilarcitos Dam, Turner Dam, Lower Crystal Springs Dam, and Calaveras Dam.
Justification:	This program is formed to address routine maintenance and capital improvements directed by DSOD and new legislation SB-92, which requires condition assessment of spillways and emergency action plans to be updated.
Operating Impact:	Reservoir operations may be restricted.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 4,200	$ 2,100	$ 1,100	$ 550	$ 150	$ 200	$ 100
Environmental Review	$ 649	$ 200	$ 50	$ 399	$ 0	$ 0	$ 0
Design	$ 1,300	$ 300	$ 300	$ 700	$ 0	$ 0	$ 0
Construction Management	$ 2,420	$ 200	$ 50	$ 1,500	$ 300	$ 200	$ 170
Construction	$ 20,078	$ 1,000	$ 800	$ 12,251	$ 1,548	$ 1,448	$ 3,031
Total	**$ 28,647**	**$ 3,800**	**$ 2,300**	**$ 15,400**	**$ 1,998**	**$ 1,848**	**$ 3,301**

Project FAMIS#:	CUW2740301
Project Title:	Regional Water - Purified Water & Other Supplies - CUW2740301
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Manisha Kothari
Asset Classification:	Water Supply and Storage Program
Type:	Capital
Description:	The SFPUC is identifying oportunities and investigating the potential for purified water projects through direct and indirect potable reuse (DPR and IPR) processes. The SFPUC is participating in research and regulatory review statewide, and is working with other Bay Area water agencies to develop potential project opportunities for up to 15 million gallons per day (mgd) of drinking water with advanced treatment technologies for water needs anticipated within the planning horizon. Feasibility analysis and pilot efforts are anticipated to advance purified water. Based on the results of the feasibility studies, we anticipate that 1-2 capital projects will be developed further within this capital planning period. The studies currently underway include: 1) the Bay Area Regional Reliability (BARR) Partnership, which includes 8 water agencies working together to identify projects to increase water supply reliability in the region. The BARR process includes a proposed Regional Market Study Pilot effort and the Bay Area Regional Desalination Project, among others; 2) the Potable Reuse Exploratory Plan (PREP) Study, which is a partnership with Silicon Valley Clean Water, Cal Water, and BAWSCA to explore the potential for source water from Silicon Valley Clean Water to be treated to drinking water standards for beneficial use (approximately 6 mgd); 3) Evaluation of Purified Water Alternatives is a partnership with Santa Clara Valley Water District and BAWSCA to explore the potential to develop viable purified water projects or exchanges; 4) Los Vaqueros Expansion Opportunities, which references an ongoing project being developed by Contra Costa Water District. The SFPUC and BAWSCA are determining whether there may be opportunity to exchange banked water for the benefit of regional customers. In addition to the these studies, additional opportunities may be developed.
Justification:	Feasibility studies will be necessary to demonstrate the viability of purified water projects. Once the project(s) that will continue to move forward with planning is/are identified, pilot testing, environmental review, design, and construction phases will all be required to implement the project within the planning period. Purified water and other supplies such as desalination are water supply options that can help meet long-term LOS goals of the SFPUC. All future work is subject to Commission approval.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 2,100	$ 1,600	$ 0	$ 200	$ 300	$ 0	$ 0
Environmental Review	$ 3,000	$ 0	$ 0	$ 2,000	$ 500	$ 500	$ 0
Design	$ 8,800	$ 1,000	$ 1,000	$ 1,300	$ 3,500	$ 2,000	$ 0
Construction Management	$ 1,500	$ 0	$ 0	$ 0	$ 0	$ 1,500	$ 0
Construction	$ 44,000	$ 0	$ 0	$ 0	$ 0	$ 0	$ 44,000
Total	**$ 59,400**	**$ 2,600**	**$ 1,000**	**$ 3,500**	**$ 4,300**	**$ 4,000**	**$ 44,000**

Project FAMIS#:	CUW2740401
Project Title:	Regional Water - Daly City Recycled Water Expansion Project - NEW - CUW2740401
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Manisha Kothari
Asset Classification:	Water Supply and Storage Program
Type:	Capital
Description:	The Daly City Recycled Water Expansion Project was originally envisioned and planned under Local Water CUW 278 (Other Recycled Water Projects). Planning for this and other recycled water projects was completed and identified in the Local CIP. As the planning for the Daly City Recycled Water Expansion Project has evolved, the 3 MGD capacity identified would help offset groundwater pumping in the Westside Basin and potential demands from the Regional Water System (RWS). The project is in the design phase (about 30%).
Justification:	A feasibility study has been completed as part of CUW278. The project will benefit RWS users and is considered a regional project. By helping to offset pumping in the Westside Groundwater Basin, the project also enhances the Groundwater Storage and Recovery (GSR) project and its ability to deliver water supply during droughts.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 9,750	$ 0	$ 0	$ 0	$ 9,750	$ 0	$ 0
Construction	$ 75,250	$ 0	$ 0	$ 0	$ 20,000	$ 35,000	$ 20,250
Total	**$ 85,000**	**$ 0**	**$ 0**	**$ 0**	**$ 29,750**	**$ 35,000**	**$ 20,250**

Project FAMIS#:	CUW2740103
Project Title:	Regional Water - San Andreas Dam Facility Improvements - CUW2740103
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Annie Li
Asset Classification:	Water Supply and Storage Program
Type:	Capital
Description:	The scope of this project includes: seismic stability evaluation and upgrade of San Andreas Dam bridge; 2) design and construction of San Andreas Emergency drawdown outlets($5M); and 3) other structure and pavement repairs and improvements($ 400K). Probable spillway construction work needed at San Andreas in the out years ($20M).
Justification:	The San Andreas Dam Bridge is the primary access to the Dam operations and does not meet current seismic codes. If the bridge failed in a seismic event, the inspections and operation of the dam and reservoir will be significantly impaired. The San Andreas emergency drawdown outlets are required by the State Division of Safety of Dams (DSOD).
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 800	$ 400	$ 400	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 200	$ 100	$ 100	$ 0	$ 0	$ 0	$ 0
Design	$ 600	$ 300	$ 300	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 600	$ 300	$ 300	$ 0	$ 0	$ 0	$ 0
Construction	$ 23,472	$ 1,000	$ 2,200	$ 32	$ 32	$ 32	$ 20,176
Total	**$ 25,672**	**$ 2,100**	**$ 3,300**	**$ 32**	**$ 32**	**$ 32**	**$ 20,176**

Project FAMIS#:	CUW2740104
Project Title:	Regional Water - Turner Dam and Reservoir Improvements - CUW2740104
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Stacie Feng
Asset Classification:	Water Supply and Storage Program
Type:	Capital
Description:	The scope of this program includes capital improvements of spillway, dam, outlet structure and all ancillary release facilities.
Justification:	Legislation SB92 directed the SFPUC to perform a condition assessment of the Turner Dam spillway. Improvements identified from that condition assessment will be funded by this project.
Operating Impact:	If Turner Dam spillway is deemed unsafe, there may be operating and/or storage restrictions to the San Antonio Reservoir.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 950	$ 50	$ 50	$ 300	$ 400	$ 150	$ 0
Environmental Review	$ 800	$ 100	$ 100	$ 200	$ 300	$ 100	$ 0
Design	$ 950	$ 50	$ 50	$ 200	$ 600	$ 50	$ 0
Construction Management	$ 950	$ 50	$ 50	$ 100	$ 700	$ 50	$ 0
Construction	$ 7,500	$ 200	$ 200	$ 300	$ 6,500	$ 300	$ 0
Total	**$ 11,150**	**$ 450**	**$ 450**	**$ 1,100**	**$ 8,500**	**$ 650**	**$ 0**

Project FAMIS#:	CUW2740501
Project Title:	Regional Water - Merced Manor Reservoir Facilities Repairs - CUW2740501
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Annie Li
Asset Classification:	Water Supply and Storage Program
Type:	Capital
Description:	1. Merced Manor Reservoir - Concrete Spalling Repair project The roof structure of the Merced Manor Reservoir was inspected and evaluated by SFPUC structural engineers in 1995 and determined that seismic strengthening and repair of the roof structure is needed. This project is to implement the recommendations from the seismic evaluation and inspection of the roof structure of Merced Manor Reservoir. Scope of the project will include performing a structural evaluation of the existing roof structure per current seismic code, developing design for seismic strengthening and repair, and construction.
Justification:	Seismic strengthening and repair to the Merced Manor Reservoir roof structure is needed to ensure the function of the reservoir and the ability to deliver water to the Merced Manor zone after a major earthquake.
Operating Impact:	Seismic strengthening and repair to the Merced Manor Reservoir roof structure is needed to ensure water delivery to the Merced Manor zone with normal operations and after a major earthquake.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 6,432	$ 6,432	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 6,432**	**$ 6,432**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW27502
Project Title:	Regional Water - Bay Area Watershed and ROW Protection Program - CUW27502
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Tim Ramirez
Asset Classification:	Watersheds and Land Management
Type:	Capital
Description:	The purpose of this program is to support capital projects that improve and/or protect the water quality and/or ecological resources that affect or are affected by the operation of the SFPUC water supply system within the Bay Area counties. Projects may include the repair, replacement, maintenance, and/or construction of roads, water systems, fences, or trails that meet these purposes. Projects may also include the acquisition of easements and/or fee title of properties that meet these purposes (within the Pilarcitos Creek, San Mateo Creek, or Alameda Creek watersheds), and other ecosystem restoration or public access, recreation, and education projects.
Justification:	This program provides funding to support capital projects that protect and restore the natural resources under SFPUC management, and improve the ability to cost-effectively manage trails, fences, roads, water systems and bridges within the watersheds.
Operating Impact:	This project provides the resources required for the long-term management of SFPUC watershed and ROW lands, which minimizes the environmental regulatory risk and long-term costs associated with the protection of natural resources that affect or are affected by the operation of the SFPUC water supply system. All projects are the responsibility of existing Natural Resources and Lands Management Division staff.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 10,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 5,000
Total	**$ 10,000**	**$ 1,000**	**$ 1,000**	**$ 1,000**	**$ 1,000**	**$ 1,000**	**$ 5,000**

Project FAMIS#:	CUW28600
Project Title:	Regional Water - Long Term Monitoring & Permit Program (Capital) - NEW - CUW28600
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Tim Ramirez
Asset Classification:	Watersheds and Land Management
Type:	Capital
Description:	The purpose of this program is to meet the long-term monitoring and permit requirements associated with capital projects and the operation and maintenance of the SFPUC water supply system and watershed/ROW lands within the Bay Area. Projects with long-term monitoring required by environmental permits include the Alameda Watershed Habitat Conservation Plan, WSIP-related environmental mitigation and permit requirements (i.e., Bioregional Habitat Mitigation Program) and non-WSIP capital projects.
Justification:	This program provides the resources to comply with terms and conditions in state and federal environmental permits associated with construction and/or operations and maintenance of the SFPUC water system, and watershed and ROW lands.
Operating Impact:	By providing the resources to comply with conditions and state and federal environmental regulatory permits, this program will minimize the risk and long-term costs associated with operation and maintenance of the SFPUC water supply system and watershed and ROW lands. As additional capital projects are completed, long-term monitoring funding will be requested as needed to meet conditions in state and federal environmental regulatory permits.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 43,008	$ 10,076	$ 11,521	$ 4,119	$ 3,924	$ 3,457	$ 9,911
Total	**$ 43,008**	**$ 10,076**	**$ 11,521**	**$ 4,119**	**$ 3,924**	**$ 3,457**	**$ 9,911**

Project FAMIS#:	CUW2760101
Project Title:	Regional Water - Microwave Backbone Upgrade - CUW2760101
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Mary Ellen Carroll
Asset Classification:	Communication and Monitoring Program
Type:	Capital
Description:	1. Expansion of the SFPUC Microwave network starting in FY2019 to include the Thomas Shaft facility and surrounding area for security, radio communications and SCADA purposes. Includes development of intermediate radio site required to reach Thomas Shaft from existing Backbone site. ($600K) 2. Replacement of Microwave network equipment with over 10 years of in-service life in 2028. ($1.0M) 3. The radio project replaces the Water Enterprise low frequency land mobile radio system. SFPUC currently uses two radio systems. The first system, operated by the Department of Emergency Management ("DEM"), is a Motorola 700/800 MHz standard public safety radio system. It is used by the City and County of San Francisco ("CCSF"), SFPUC's Wastewater Enterprise, Power Enterprise, Customer Service Bureau, as well as the City Distribution Division's Auxiliary Water Supply System personnel and Gatemen. The second system is a low frequency radio system, used by SFPUC's Water Enterprise that spans seven counties. In January 2017, SFPUC Information Technolgy Services ("IT Services") issued a Request for Proposal ("RFP") to find a qualified Proposer to replace the Water Enterprise's low frequency radio system with a solution that best met the coverage and feature requirements outlined in the RFP. The winning proposal is from Motorola Solutions who offered a standard P-25 system at a total caplital cost of $9,121,131 over ten years. Funding will come from multiple sources with - CUW276 - funding $2,838,647.65 of the cost. ($2.6M in FY18; $200K in FY 20).
Justification:	The project will provide much needed redundant emergency communication capability and increased bandwidth for security data transfer.
Operating Impact:	The project will improve current day-to-day radio communication and security data provision in additional to providing critical redundant emergency communication capability.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 1,450	$ 450	$ 0	$ 0	$ 0	$ 0	$ 1,000
Total	**$ 1,450**	**$ 450**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 1,000**

Project FAMIS#:	CUW2760201
Project Title:	Regional Water - WST Security System - CUW2760201
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Mary Ellen Carroll
Asset Classification:	Communication and Monitoring Program
Type:	Capital
Description:	Design, construct and integrate security infrastructure for the Water Supply and Treatment Division and expand current systems. Design, construct, install and integrate new systems at existing sites.
Justification:	While much of the water system has or will be receiving security system upgrades through WSIP, not all sites are covered and some sites were not fully funded for needed security system upgrades. In addition, this provides a funding source to include security system upgrades in future capital improvement projects.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 5,080	$ 500	$ 500	$ 500	$ 500	$ 500	$ 2,580
Total	**$ 5,080**	**$ 500**	**$ 500**	**$ 500**	**$ 500**	**$ 500**	**$ 2,580**

Project FAMIS#:	CUW27701
Project Title:	Regional Water - Sunol Yard Upgrade - CUW27701
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Bryan Dessaure
Asset Classification:	Buildings and Grounds Program
Type:	Capital
Description:	Many of the existing facilities in the Sunol Yard are in extreme disrepair and in need of replacement. The project will replace the existing facilities, add storage facilities and reconfigure the Yard layout. Specific improvements include a new LEED Gold Administration Building; three Shop Buildings; equipment and material Storage Facilities; sanitary and storm drainage collection systems; underground utility systems; Fuel Station with above ground tanks; security-card reader systems; security upgrades; parking for SFPUC staff, visiting SFPUC staff, guest and public vehicles; locker and shower facilities; site improvements, Temple Road and the Temple area improvements; and hazardous materials storage facility. The project also includes a LEED Gold Watershed Center that will include interior exhibits and displays; a variety of interactive and hands-on exhibits; classroom; wet lab; staff offices; restrooms; event gathering space with kitchen; conference room; outdoor patios; picnic and play areas; and a discovery trail and garden area to represent the various reaches of the Watershed.
Justification:	Existing facilities are dilapidated, and do not meet present and future needs.
Operating Impact:	Interim improvements will increase security, lower utility bills (energy), and decrease maintenance costs; overall savings of $10K per year.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 3,193	$ 286	$ 295	$ 304	$ 313	$ 322	$ 1,673
Total	**$ 3,193**	**$ 286**	**$ 295**	**$ 304**	**$ 313**	**$ 322**	**$ 1,673**

Project FAMIS#:	CUW27703
Project Title:	Regional Water - Millbrae Yard Upgrade - CUW27703
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Chris Nelson
Asset Classification:	Buildings and Grounds Program
Type:	Capital
Description:	Many of the existing facilities in the Millbrae Yard are in disrepair and in need of replacement. Staff will use this facility at least for the next 10 years and improvements are necessary for general safety and functionality.
Justification:	Existing facilities are dilapidated, and do not meet present and future needs.
Operating Impact:	Interim improvements will increase security and decrease maintenance costs; overall savings of $20K per year. Existing laboratory was retrofitted into an existing office building, and as such, the space was not originally design nor is conducive for such purposes.

All values in $1,000	**2019-2028**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024-2028**
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 7,165	$ 1,500	$ 1,500	$ 500	$ 500	$ 515	$ 2,650
Total	**$ 7,165**	**$ 1,500**	**$ 1,500**	**$ 500**	**$ 500**	**$ 515**	**$ 2,650**

Project FAMIS#:	CUW2770101
Project Title:	Regional Water - Sunol Long Term (Watershed Center) - CUW2770101
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Bryan Dessaure
Asset Classification:	Buildings and Grounds Program
Type:	Capital
Description:	Many of the existing facilities in the Sunol Yard are in extreme disrepair and in need of replacement. The project will replace the existing facilities, add storage facilities and reconfigure the Yard layout. Specific improvements include a new LEED Gold Administration Building; three Shop Buildings; equipment and material Storage Facilities; sanitary and storm drainage collection systems; underground utility systems; Fuel Station with above ground tanks; security-card reader systems; security upgrades; parking for SFPUC staff, visiting SFPUC staff, guest and public vehicles); locker and shower facilities; site improvements, Temple Road and the Temple area improvements; and hazardous materials storage facility. The Sunol Yard Administration Building has been funded in the previous CIP. Funding below is costed to build a LEED Gold Watershed Center that will include interior exhibits and displays; a variety of interactive and hands-on exhibits; classroom; wet lab; staff offices; restrooms; event gathering space with kitchen; conference room; outdoor patios; picnic and play areas; and a discovery trail and garden area to represent the various reaches of the Watershed.
Justification:	Most structures in the Sunol Yard have been converted from their original purpose including a residence now used as an office building, a farming barn now used as shops, and trailers used as office space, locker rooms and storage. The yard is unpaved which affects access and use in the rainy season and generates significant dust in the summer. Covered storage space is inadequate and many maintenance and storage activities are performed outside. The proposed upgrades are to rebuild most facilities in the Sunol Yard to match job functions with appropriate space and structures.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 7,750	$ 2,750	$ 2,500	$ 2,500	$ 0	$ 0	$ 0
Construction	$ 26,000	$ 26,000	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 33,750**	**$ 28,750**	**$ 2,500**	**$ 2,500**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW2770601
Project Title:	Regional Water - Buildings & Grounds All Locations - CUW2770601
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Chris Nelson
Asset Classification:	Buildings and Grounds Program
Type:	Capital
Description:	CUW277-0601 Buildings and Grounds All locations scope, in no particular order ($13M) Millbrae: 1. Haz. Mat. Removal $160,00 2. Building Rot Repair $184,000 3. Diesel Spill Cleanup $40,000 4. Planning - Plumbing Shop $25,000 5. Security Upgrades $815,000 6. IT Server Facilities and Pilarcitos Conference Room Upgrades $400,000 7. Yard Waste Oil Tank Replacement $250,000 8. Development of secured outdoor storage for warehouse. $50,000 9. Yard Access, Water Conservation and Landscaping Upgrades $750,000 10. Truck Wash and Yard drainage and pavement repairs $1,000,000 11. Yard Covered parking for equipment & materials storage $250,000 12. Pulgas Temple Access, Water Conservation and Landscaping Upgrades $2,000,000 13. Millbrae Yard lighting behind warehouse 14. Millbrae yard ADA path and ramp to emergency exit gate 15. Millbrae Yard public announcement system 16. Millbrae yard fencing along Caltrain Tracks 17. Pulgas Dechlor storage, lighting, HVAC 18. CSPS ? old pump station building repurposing 19. Sunol Plant kitchen and lab mold remediation 20. Baden Valve Lot drainage issues
Justification:	Existing facilities are dilapidated, and do not meet present and future needs.
Operating Impact:	Improvements will increase security, lower utility bills (energy), and decrease maintenance costs.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 13,000	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 5,500
Total	**$ 13,000**	**$ 1,500**	**$ 1,500**	**$ 1,500**	**$ 1,500**	**$ 1,500**	**$ 5,500**

SFPUC Capital Project Plan
Water Enterprise
Regional Water

Project FAMIS#:	CUW2770301
Project Title:	Regional Water - Millbrae Long Term - CUW2770301
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Bryan Dessaure
Asset Classification:	Buildings and Grounds Program
Type:	Capital
Description:	The project will include improvements to the Millbrae Yard. The Millbrae Yard improvements include renovations of the existing administration building to expand and improve laboratory functions, a new shop building, consolidation of operations staff onto one campus, security upgrades and improvements to address occupational issues within the Administration Building and the Yard, sidewalks and warehouse settlement scope at Millbrae Yard.
Justification:	The SFPUC's main laboratories were based on late 1970s designs and constructed in the early 1980s. They were designed to conduct measurements in the parts per million and parts per billion ranges, with safety and other factors of the time. Technology, regulatory, safety, work load and other factors have dramatically increased over the past 30 years. Measurements are now in the parts per billion to parts per trillion ranges, with some going into the parts per quadrillion range. The need is for a facility that can meet the SFPUC needs from the late 2010's through the late 2040's; one that will reliably meet new technological, regulatory, and other requirements.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 32,500	$ 2,700	$ 27,000	$ 2,800	$ 0	$ 0	$ 0
Total	**$ 32,500**	**$ 2,700**	**$ 27,000**	**$ 2,800**	**$ 0**	**$ 0**	**$ 0**

SFPUC Capital Project Plan
Water Enterprise
Regional Water

Project FAMIS#:	CUW2770501
Project Title:	Regional Water - Rollins Road Building - CUW2770501
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Chris Nelson
Asset Classification:	Buildings and Grounds Program
Type:	Capital
Description:	Capital and maintenance improvements will be needed after purchasing the Rollins Road Building. The SFPUC recently purchased the Rollins Road Building which is occupied by WQB, NRD and WSTD staff and a tenant operating a medical facility. The tenant will vacate the building in the near future and the space will be available for SFPUC use. The improvements include renovating and expanding the space currently occupied by SFPUC to accommodate WQB and IT staffing and space needs. The space currently occupied by the medical facility will be reconfigured to accommodate NRD staff. Other improvements include security, HVAC and fencing upgrades, site landscaping, repaving and striping the parking lot and driveway, installing a new roof and building painting.
Justification:	Existing facilities are dilapidated, and do not meet present and future needs.
Operating Impact:	Interim improvements will increase security and decrease maintenance costs.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 4,650	$ 850	$ 750	$ 500	$ 400	$ 400	$ 1,750
Total	**$ 4,650**	**$ 850**	**$ 750**	**$ 500**	**$ 400**	**$ 400**	**$ 1,750**

Project FAMIS#:	CUW30103
Project Title:	Regional Water - Regional Groundwater Storage and Recovery (WSIP) - CUW30103
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Tracy Cael
Asset Classification:	Base Funded by WSIP
Type:	Capital
Description:	The project is to develop a groundwater supply in the South Westside Basin for use during dry years. In normal and wet years, the SFPUC will supply supplemental surface water to three wholesale customers on the Upper Peninsula (the Cities of Daly City and San Bruno, and the California Water Service Company - South San Francisco District) to be used in place of groundwater pumping. The reduced pumping during normal and wet years will thereby increase the volume of groundwater in storage that can be pumped in dry years. The project consists of the construction of up to 16 groundwater wells and well stations with a total capacity of 7.2 mgd to be used as a regional dry-year water supply. The wells will be connected to the three wholesale customers' water systems and to the SFPUC transmission system. Disinfection will be required for all wells and treatment may be required at some of the wells for the removal of manganese.
Justification:	This project is funded through construction and close-out up to the budget specified in WSIP. Additional funding is requested through the Local CIP to cover the cost differential.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 7,000	$ 7,000	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 7,000**	**$ 7,000**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW352
Project Title:	Regional Water - Alameda Creek Recapture (WSIP) - CUW352
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Bryan Dessaure
Asset Classification:	Base Funded by WSIP
Type:	Capital
Description:	The project consists of facilities in the Sunol Valley for the recapture of water released from the Calaveras Dam and bypassed at the Alameda Creek Diversion Dam for fisheries habitat enhancement in Alameda Creek. The proposed project includes The proposed project includes a pump station and conveyance facilities to recapture water that naturally infiltrates from Alameda Creek into an existing quarry pond F2 of SMP-24 in the Sunol Valley.
Justification:	To fund additional environmental review and construction costs.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 3,000	$ 3,000	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 3,000**	**$ 3,000**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW374 ACDD
Project Title:	Regional Water - Alameda Creek Diversion Dam (WSIP) - CUW374 ACDD
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	
Asset Classification:	Base Funded by WSIP
Type:	Capital
Description:	The Alameda Creek Diversion Dam (ACDD), which diverts water from Alameda Creek to Calaveras Reservoir, will be modified with a new flow bypass tunnel and valve to allow for downstream flows below the ACDD. The bypass flows at ACDD, together with flow releases from new low-flow capacity valves installed at the base of the replacement Calaveras Dam, will provide water downstream of these facilities to support native aquatic resources and future populations of steelhead trout that are being restored to the Alameda Creek Watershed.
Justification:	To fund additional construction changes due to differing site conditions.
Operating Impact:	

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 5,000	$ 5,000	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 5,000**	**$ 5,000**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW374 CDRP
Project Title:	Regional Water - Calaveras Dam (WSIP) - CUW374 CDRP
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Susan Hou
Asset Classification:	Base Funded by WSIP
Type:	Capital
Description:	The project consists of the replacement of the original dam which is seismically unsafe with a new 210-foot high earth and rock fill dam designed to accommodate a maximum credible earthquake on the Calaveras Fault. The dam will be constructed immediately downstream of the existing dam and will have a crest length of 1,210 feet, a base thickness of 1,180 feet, and a crest thickness of 80 feet. The total volume of the dam will be approximately 2.8 million cubic yards. A new spillway, stilling basin, and intake tower/shaft will be constructed. The drain line and three adits from the existing facility will be connected to the new shaft. The existing dam will largely remain in-place but will be modified to accommodate the construction and operation of the new replacement dam. The replacement dam will restore the original reservoir capacity, and it will be designed such that it can be raised to accommodate potential reservoir enlargement in the future. In addition, the Alameda Creek Diversion Dam (ACDD), which diverts water from Alameda Creek to Calaveras Reservoir, will be modified with a new flow bypass tunnel and valve to allow for downstream flows below the ACDD. The bypass flows at ACDD, together with flow releases from new low-flow capacity valves installed at the base of the replacement Calaveras Dam, will provide water downstream of these facilities to support native aquatic resources and future populations of steelhead trout that are being restored to the Alameda Creek Watershed.
Justification:	To fund additional construction changes due to differing site conditions.
Operating Impact:	None

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 34,000	$ 34,000	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 34,000**	**$ 34,000**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUWBDP
Project Title:	Regional Water - WSIP Closeout - Bay Division (WSIP) - CUWBDP
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Tracy Cael
Asset Classification:	Base Funded by WSIP
Type:	Capital
Description:	This project includes miscellaneous improvements to ensure the WSIP Level of Service (LOS) goals and objectives are fully achieved in the Bay Division region. The work will be completed by means of several sub-projects, including: developing an agreement with Caltrans for a drainage system across SFPUC ROW between the Caltrans storm-water invert and an open field associated with the construction of the Seismic Upgrades of BDPL Nos. 3 and 4 and decommissioning of the existing BDPL Nos. 1 and 2 as required by the EIR; and uncovering of previously installed valve E50U to provide for removal, cleaning, and re-installation of bolts; testing; and possible installation of new bolt sleeves for corrosion protection purposes.
Justification:	TBD
Operating Impact:	TBD

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 2,000	$ 2,000	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 2,000**	**$ 2,000**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUWPWI
Project Title:	Regional Water - WSIP Closeout - Peninsula (WSIP) - CUWPWI
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Tracy Cael
Asset Classification:	Base Funded by WSIP
Type:	Capital
Description:	This project consists of miscellaneous improvements to ensure the WSIP Levels of Service (LOS) are fully achieved in the Peninsula region. The work will be completed by means of several sub-projects, including the Lower Crystal Springs Dam (LCSD) stilling basin modifications, valve modifications for fish passage at the same site, New Crystal Springs Bypass Tunnel electrical modifications, closeout of California Division of Safety of Dams permit applications, and coordination with San Mateo County for bridge construction over LCSD.
Justification:	
Operating Impact:	

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 7,000	$ 7,000	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 7,000**	**$ 7,000**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUWSJI
Project Title:	Regional Water - WSIP Closeout - San Joaquin Region (WSIP) - CUWSJI
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Yolanda Quisao
Asset Classification:	Base Funded by WSIP
Type:	Capital
Description:	The project includes Job Order Contracts (JOCs) for solar panel upgrades and a structural slab retrofit. The solar panel JOC will add new solar panels to supplement existing solar panels for existing onsite equipment operations at San Joaquin No.4 Junction, at the Throttling Station at Knight's Ferry and at Oakdale Portal, and eliminate the need for propane generators at these sites. The project also includes the retrofit installation of an interior slab and drainage improvements at Tesla Portal. The original slab was deleted during the portal construction to allow access for corrosion repairs of existing pipelines under the slab.
Justification:	TBD
Operating Impact:	TBD

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 2,000	$ 2,000	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 2,000**	**$ 2,000**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUWSVI
Project Title:	Regional Water - Joint Infrastructure - CUWSVI
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Tracy Cael
Asset Classification:	Base Funded by WSIP
Type:	Capital
Description:	The project includes one design/bid contract and two Job Order Contracts (JOCs): Sunol Valley Water Treatment Plant Basin 5 Optimization - This design/bid subproject will add and develop a range of flocculation aid polymer doses for the no. 5 sedimentation basin of the plant to enable the basin to meet a water production goal of 40 mgd consistently. SABPL Erosion Repairs at Pond F3 East - This JOC subproject will repair the existing outfall pipe erosion at Quarry Pond F3 East with grouted riprap rockfill and restore the drain pipe. The outfall drainage system was originally installed as part of the San Antonio Backup Pipeline. AS4 Carrier Water System Modifications - This JOC subproject will modify the chemical injection system of the Alameda Siphons No.4 Pipeline to overcome lack of water system volume and pressure needed to inject water treatment chemicals.
Justification:	TBD
Operating Impact:	TBD

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 2,000	$ 2,000	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 2,000**	**$ 2,000**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

SFPUC Capital Project Plan
Water Enterprise
Local Water

Project FAMIS#:	CUW280
Project Title:	Local Water - Local Water Conveyance / Distribution System - CUW280
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	
Asset Classification:	Water Transmission Program
Type:	Capital
Description:	This long-term program funds management of linear assets in the potable water distribution system between transmission or storage and final customer service connection. 1. Linear Asset Management Program: replaces and renews feeder and distribution mains for the 1,230 miles of pipe distribution system. Funding for 15 miles per year of pipes replaced or upgraded was approved by the Commission in 2011. Improvements include replacement, rehabilitation, relining, and cathodic protection of all pipe size categories to extend or renew pipeline useful life. Coordination with construction projects by other City agencies, especially SFPUC Sewer and DPW Paving, is emphasized to optimize efficiencies and minimize customer disruptions. In FY19 - F21, majority of the funding will be committed to pipe replacement projects in major transit corridors, where street improvement projects by other agencies (CalTrans, SFMTA, SFCTA, DPW) are being constructed; these projects are more expensive due to traffic impacts and agency coordination. Starting in FY19 the program goals will include replacement of 1 miles per year of seismically-reliable transmission pipelines at a cost of $6.0M per mile in order to meet seismic reliability levels of service. 2. Renew Services: renews assets between the water main and the customer's service connection, including: 1-inch to 8-inch diameter service pipes made of galvanized steel, lead and plastic, to be replaced with copper or ductile iron; broken meter boxes; outdated or broken meters and associated piping; and subsequent associated sidewalk and roadway restoration. This program also renews gate valves and pressure reducing valves in the pipe network. The program is typically funded at $3 million annually. The FY19 and FY20 Program costs of $56.1M include the following: 1) replacement of 11 miles of distribution pipelines at $3.83M per mile; 2) replacement of 1 mile with seismically reliable pipelines at $6M per mile; 3) Service line renewal program at $3M; and 4) $5M for planning and engineering. For FY21 and beyond the funding is escalated at about $1M annually.
Justification:	FY19 and 20 cost estimates are based on actual construction costs and escalation rates in FY16-18. Extensive review of pipe age and condition revealed that a higher replacement rate is needed to continue meeting LOS goals to minimize disruption of service to customers. Currently, 16% of the system's 1,230 miles of mains exceed their typical 100-year useful life. At past replacement rate of 6 miles/year, over 20% of the mains will exceed their recommended useful life by year 2025. By 2040, over 50% of mains will exceed the useful life, increasing the rate of main breaks, resulting in expensive property/street damage, domestic/commercial service disruption, and the potential threat to public health/safety. Increasing the replacement/renewal rate to 15 miles/year will enhance the probability of maintaining LOS goals for customer service through year 2035. In 2035, more aggressive capital improvements may be necessary to maintain LOS goals. Coordinating main replacements with transit corridor street improvement project stakes advantage of current construction opportunities and minimizes risk of main breaks from old pipes and community disruption after construction.
Operating Impact:	Main breaks due to aging infrastructure cause service disruption and result in costly property damage and need for emergency repairs. Increasing the pipeline renewal rate will help prevent potential increased rate of main breaks, thus maintaining or slightly increasing operational costs to respond to main and service connection breaks. Some additional CDD labor will be required to connect replaced mains to existing services as capital projects increase. This labor cost is captured in planned capital budgets. New proposal for additional off budget positions is being submitted in FY19 budget cycle to add additional construction positions required to meet 15-mile construction target.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 50,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 25,000
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 550,500	$ 51,100	$ 51,100	$ 52,000	$ 53,000	$ 54,000	$ 289,300
Total	**$ 600,500**	**$ 56,100**	**$ 56,100**	**$ 57,000**	**$ 58,000**	**$ 59,000**	**$ 314,300**

Project FAMIS#:	CUWSP
Project Title:	Local Water - Sunset Pipeline - CUWSP
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	
Asset Classification:	Candidates
Type:	Capital
Description:	This project provides funding for the design and construction of about 4 miles of large diameter Earthquake Resistant Ductile Pipeline to improve the fire water and potable supply reliability in the western area of San Francisco, particularly in the Sunset and Richmond Districts. This project consists of a pump station at Sunset Reservoir, a pipeline from Sunset Reservoir going north through Golden Gate Park into Richmond district to roughly Cabrillo and 29th Ave, and seismically activated isolation valves. The pipeline will be designed as a potable AWSS pipeline, meaning it will convey low pressure potable water with connections to the distribution system during normal operations but can be isolated with motorized valves and operate under high pressure for firefighting after a major seismic event or emergency conditions. This project is currently in planning phase with detail design scheduled to be completed in 2019. Construction will be in four phases beginning in 2020 and completing in 2023. The estimate construction budget is $10M per year for 4 years with contribution of $2.8M from the ESER2 Bond in the first phase for the construction of the pump station at Sunset Reservoir and motorizing valves, and additional funding to pipeline construction in the future phases when more funding is available.
Justification:	This project was identified as part of the (ESER) Bond to improve the fire water supply reliability in the western area of San Francisco, particularly in the Sunset and Richmond Districts. In order to evaluate the ability of the EFWS to provide backup water supply following a magnitude 7.8 earthquake, the CS-199 and CS-229 Spending Plan studies delineated 46 Fire Response Areas (FRAs). The studies provided project alternatives seeking to improve each FRA's reliability score over the threshold of 50% and to achieve a citywide reliability score of at least 90%. Based on the hydraulic modeling results from the current spending plan, additional water supply is required to increase the reliability scores of FRAs within the Sunset and Richmond Districts to meet the target of 50%. As a result, the Sunset Pipeline project was proposed to improve the FRA reliability in these areas. In addition to improving the fire water supply reliability, this pipeline will be designed to also improve seismic reliability to the potable water supply under normal operation.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 2,000	$ 2,000	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 42,782	$ 0	$ 10,000	$ 10,450	$ 10,920	$ 11,412	$ 0
Total	**$ 44,782**	**$ 2,000**	**$ 10,000**	**$ 10,450**	**$ 10,920**	**$ 11,412**	**$ 0**

Project FAMIS#:	CUW686
Project Title:	Local Water - Automated Water Meter Program - CUW686
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	
Asset Classification:	Local Water
Type:	Capital
Description:	TThis project consists of the Phase III installation work that is now underway and includes the final 5% of the Automated Water Meter Program (AWMP) installations. Phase III included Contracted service under CS-1014 that concludes in November 2017 and brought the AWMP deployment to nearly 98% completion. The remaining work includes more complex and labor intensive installations requiring substantial field work which will be completed by CDD. The original budget for the capital project of $64.1 million was supplemented with an additional $3 million transferred from CDD CUW28000 in FY 16, 17, and 18. The new estimate for completing the remaining work requires an additional $1.8 million in FY 19. This process transfers that money for FY 19 which will be excluded from CUW28000's budget request. Following completion of the Phase III AWMP installations, the meter assets will require 2 CDD journeyman crews to perform improvements on the capital assets through the 20-year system life. These positions will continue to be funded by CUW28000 for meter replacements and installations in the future. FY 20+ includes continued CDD service on the capital assets. The AWMP system replacement should begin sometime around 2025 in order to successfully maintain the automated reads without risking system failure. In order to upgrade the system in the required timeframe and continue necessary SFPUC normal operations and maintenance activities, it's anticipated that Contracted installation services will again be needed to upgrade or implement a new AWMP system. Planning for this work, including the RFP and contracting process, should begin around 2023 and soft costs for that work have been requested at $500,000. A budget estimate for the system replacement costs is $66 million requested over a 3-year implementation period at $22 million/year beginning in 2025.
Justification:	A business case for the AWMP program was conducted in 2007 justifying the program implementation.
Operating Impact:	The project implementation resulted in avoided operating costs that would have been required for SFPUC's transition to monthly billing. The project also decreased the SFPUC high bill allowance program and increased meter accuracy for billing and revenue.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 1,800	$ 1,800	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 1,800**	**$ 1,800**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW278
Project Title:	Local Water - Other Recycled Water Projects - Local - CUW278
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	Barbara Palacios
Asset Classification:	Water Supply and Storage Program
Type:	Capital
Description:	CUW 278 - Other Recycled Water Projects includes potential capital projects for recycled water and purified water for the benefit of retail customers. We are currently at various levels of planning for these projects and 1-2 are likely to materialize into separate capital projects. The Daly City Recycled Water Expansion Project, for example, started as part of this group, and during design, it was decided that it would largely benefit the Regional Water System customers, so subsequent phases will be funded through a separate project CUW27402. This group includes: 1. Eastside Water Supply Project 2. Initial design/environmental review for Daly City Recycled Water Expansion Project 3. PureWaterSF Pilot project 4. Feasibility / planning for Menlo Country Club Recycled Water Project
Justification:	This project is intended to develop recycled water/purified water and is part of the SFPUC's diversified water supply strategy for retail customers.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 20	$ 0	$ 0	$ 20	$ 0	$ 0	$ 0
Design	$ 120	$ 0	$ 0	$ 120	$ 0	$ 0	$ 0
Construction Management	$ 210	$ 0	$ 0	$ 210	$ 0	$ 0	$ 0
Construction	$ 350	$ 0	$ 0	$ 350	$ 0	$ 0	$ 0
Total	**$ 700**	**$ 0**	**$ 0**	**$ 700**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW281
Project Title:	Local Water - 520 John Muir Drive - Site Rehabilitation - CUW281
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	Obi Nzewi
Asset Classification:	Buildings and Grounds Program
Type:	Capital
Description:	Scope of work includes: · Funding and oversight of EIR for recreational site redevelopment and remediation of residual contamination · Funding, permitting and overseeing effort to acquire required permits for recreational site redevelopment and remediation · Implementation of limited remediation, which will entail: o Excavation and off-haul of contaminated soils and debris from beneath an existing building onsite. o Characterization and proper offsite disposal of excavated materials o Regulatory reporting documenting final remedial activities as required by the Regional Water Quality Control Board
Justification:	To complete site compliance monitoring following remediation activities.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 1,341	$ 1,341	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 195	$ 195	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 905	$ 905	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 2,441**	**$ 2,441**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW282
Project Title:	Local Water - Systems Monitoring & Control - CUW282
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	Sam Young
Asset Classification:	Water Supply and Storage Program
Type:	Capital
Description:	This program funds various systems monitoring and control projects: 1. Improvements to facilities for controlling and monitoring San Francisco's water distribution system. Facilities include enhancements to the Supervisory Control and Data Acquisition (SCADA) for remote monitoring of pressure, flow, and valve position status at key locations throughout the distribution system. Facilities also include flow and pressure monitoring devices, remotely controlled valves and valve actuators, pressure reducing valves, associated back-up power where required, and other ancillary equipment required to meet system reliability requirements. 2. Installation of fiber optic communications to critical facilities to meet the demand for network bandwidth of the process control and security platforms. 3. Security installations not completed under the WSIP will be completed under this program.
Justification:	1. San Francisco's water distribution system includes over 22 pressure zones, 10 large storage reservoirs, 13 storage and hydropneumatic tanks, 4 pump stations, 1,230 miles of pipe, and many varied valves and pressure control facilities. Existing monitoring, only located at large reservoirs and pump stations, is inadequate to accurately assess flow and pressure throughout the distribution system. Remote control capability for closing valves is minimal. When pipes break or an unexpected operation occurs, it is difficult to remotely determine cause and effect of the event. Most of the emergency response must occur manually at the emergency site. While this can typically be responded to for individual pipe breaks, a large-scale event such as an earthquake or flood could result in multiple pipe breaks that would be difficult to locate, and even more difficult to shut off without also interrupting service to customers. Remote monitoring and control capabilities will also assist in optimizing system operations, resulting in decreased energy/pumping costs, and more efficient staffing requirements. Customers will experience increased reliability as back-up emergency water service capabilities are added through remote valve operation capability, allowing customers to be fed water through multiple pipe pathways from multiple pressure zones. 2. Fiber optic connections will allow the use of video to quickly determine the criticality of the alarms produced and the level of the response needed. 3. The completion of the security system installations is crucial to protecting the Divisions assets and provides a permanent record of all personnel entering and exiting facilities.
Operating Impact:	1. Operations should become more efficient as a result of these improvements. Day-to-day and emergency staffing needs may decrease due to remote response capabilities. Response speed and effectiveness may increase. Monitoring capabilities may help optimize pumping and reduce energy costs. 2. Increased reliability and functionality of the SCADA and security networks. Possible reduced labor costs associated with using video to confirm remote conditions/alarms. Enhanced security capabilities including the ability to account for personnel entering and exiting facilities. Video surveillance and documentation of remote sites. Reduced operating costs associated with remote confirmation of alarm conditions.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 2,457	$ 200	$ 209	$ 218	$ 228	$ 239	$ 1,363
Total	**$ 2,457**	**$ 200**	**$ 209**	**$ 218**	**$ 228**	**$ 239**	**$ 1,363**

Project FAMIS#:	CUW283
Project Title:	Local Water - Local Tanks/Reservoir Improvements - CUW283
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	Don Lampe
Asset Classification:	Water Supply and Storage Program
Type:	Capital
Description:	This project provides long-term funding for the renewal and rehabilitation of 10 major water storage reservoirs and 6 storage tanks that range in age from 50 to 120 years old. While the Water System Improvement Program provided some seismic and water quality improvements at several of the facilities, all the sites have ongoing and emerging needs to address seismic, maintenance access, electrical, structural, and other deficiencies. The College Hill Reservoir, constructed in 1870 and San Francisco's oldest water reservoir, was seismically retrofitted in 2001. However, the aging outlet structure was not retrofitted, and is at risk of failure during a seismic event. This reservoir supplies much of the eastern and northern areas of San Francisco, including San Francisco General Hospital, the City's trauma center. Preliminary Design Reports completed in FY17 recommended installation of a new control valve vault; replacement of reservoir inlet and outlet piping; replacement of reservoir transmission pipelines up to Cortland Avenue; reservoir roof replacement; and miscellaneous piping, security, site access, electrical, instrumentation, and water quality improvements. Construction costs are estimated at $12 million and construction is anticipated to start in 2019. Merced Manor Reservoir has concrete spalling on the side wall and roof that, if not repaired, could cause costly and permanent damage to the reservoir. In FY19, the repair needs will be reviewed, and a project plan created for design in FY18 and construction in FY20. Preliminary construction cost estimate is $3 million. Forest Hill Tanks require improvements to valve actuation to allow automated level control, and also internal mixing improvements, to improve water quality; these tanks frequently have low chlorine residual and result in high maintenance requirements and risk of water quality violation.
Justification:	Because College Hill Reservoir supplies a critical mid-elevation portion of the distribution system, including San Francisco General Hospital, Upper Market Street, the Civic Center, and City Hall, it needs to be seismically reliable following a major seismic event. Replacing the outlet structure will allow seismically reliable distribution of water from this reservoir. This project is one part of the SF General Hospital Water Seismic Reliability Program that provides seismically reliable piping from College Hill Reservoir to SF General Hospital. If repairs are not made at Merced Manor, the long-term repairs will be significantly more costly, and collapse or rupture of the wall or roof could result in a major interruption to water service. Minor mixing and level control improvements at Forest Hills Tanks will save long-term operational and maintenance costs for manual chlorine addition and reduce risk of not meeting water quality requirements.
Operating Impact:	Replacement of the outlet pipe may cause a short duration outage of the reservoir that can be accommodated by operational work-arounds. However, if the outlet pipe is not replaced and fails, this would cause a significant impact to Operations to reliably supply water to the College Hill distribution zone.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 500	$ 500	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 13,100	$ 9,600	$ 3,000	$ 300	$ 200	$ 0	$ 0
Total	**$ 13,600**	**$ 10,100**	**$ 3,000**	**$ 300**	**$ 200**	**$ 0**	**$ 0**

Project FAMIS#:	CUW284
Project Title:	Local Water - Pump Station Improvements - CUW284
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	
Asset Classification:	Pump Stations
Type:	Capital
Description:	This project provides long-term funding for renewal and rehabilitation of 12 major water pump stations and 7 hydropneumatic tanks that boost pressure within the San Francisco distribution system. While the Water System Improvement Program provided some seismic and pumping capacity improvements at several of the facilities, all the sites have ongoing and emerging needs to address seismic, maintenance access, electrical, mechanical, and other potential deficiencies. This project will rebuild the McLaren Park pump station. Project scope includes demolition of existing building, construction of a new reinforced concrete building with bridge crane, new pumps, sprinkler system, new electrical system, new stand-by generator and generator building, replacement of surge tanks, security fencing, water quality monitoring, landscaping and other site work. This project will also provide the necessary facilities to support the Supervisory Control and Data Acquisition (SCADA) project by adding automation where needed. Design is anticipated in FY17 and FY18, and construction in FY19. The Bay Bridge Pump Station pumps water to storage facilities on Treasure and Yerba Buena Islands (TI/YBI)residents. This is the only pump station for TI/YBI, and thus needs to be highly reliable, especially as the future population grows to anticipated 20,000 residents. This project will fund a condition assessment, design and construction of upgrades to improve the reliability of this essential facility. Design will be in FY17 and FY18, and construction in FY19. Back-up electrical generators at all pump stations need to be assessed for reliability of exhaust filtering devices that may have been oversized, resulting in premature clogging and unintentional shutdown of the generators. "Active" self-cleaning devices may result in higher reliability of the gen-sets; cost is estimated at $2 million to replace these devices. Other generator needs will be evaluated at each site. Repairs will
Justification:	Facility improvements to McLaren Park pump station will ensure it continues to provide operational redundancy to Alemany Pump Station in supplying water to the McLaren Park zone. McLaren Park pump station suction lines are fed directly off the Crystal Springs Pipelines. This arrangement provides additional operational flexibility as it does not rely on water storage from University Mound reservoir system. Bay Bridge Pump Station is a critical facility that must be able to run reliably every day in order to refill potable water storage tanks on TI/YBI; this system is the sole provider of water service and fire protection to TI/YBI residents and visitors. Generators at pump stations must be reliable to provide back-up power during electrical outages and emergencies; deficiencies that reduce the ability of the gen-sets to meet design criteria must be corrected.
Operating Impact:	McLaren Park Pump Station, Bay Bridge Pump Station, and the back-up generators at all of the pump stations are critical facilities that must run reliably every day to deliver water to storage reservoirs and customers. Repairs and improvements to these facilities are essential to meet Levels of Service Goals and provide adequate fire protection.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 95	$ 95	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 50	$ 50	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 862	$ 112	$ 750	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 20,275	$ 675	$ 1,500	$ 17,500	$ 600	$ 0	$ 0
Total	**$ 21,282**	**$ 932**	**$ 2,250**	**$ 17,500**	**$ 600**	**$ 0**	**$ 0**

Project FAMIS#:	CUW30201
Project Title:	Local Water - SF Westside Recycled Water (Non WSIP) - CUW30201
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	
Asset Classification:	Base Funded by WSIP
Type:	Capital
Description:	This project includes all facilities to produce and deliver about 2 mgd of recycled water for irrigation use in the western end of San Francisco. The project includes a new recycled water treatment facility consisting of membrane filtration, reverse osmosis, and ultraviolet light disinfection; a 1.1 million gallon storage reservoir; distribution pumping facilities; and 5 to 6 miles of new pipelines.
Justification:	This project is funded through construction and close-out up to the budget specified in WSIP. The project scope was unconfirmed with respect to treatment facility siting at the time it was funded. With the recommendation of an alternate site, the project budget has increased due to additional pipeline costs, additional engineering and environmental review for the new alternative, and added escalation costs due to delay. Additional funding is requested through the Local CIP to cover the cost differential. The additional funding will be needed when the project goes to construction.
Operating Impact:	A minimum O&M cost of approximately $1.6 M per year (chemicals, power, staffing, etc.) would be anticipated.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 7,000	$ 6,500	$ 500	$ 0	$ 0	$ 0	$ 0
Total	**$ 7,000**	**$ 6,500**	**$ 500**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW688
Project Title:	Local Water - Buildings & Grounds Improvements - Local - CUW688
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	Don Lampe
Asset Classification:	Buildings and Grounds Program
Type:	Capital
Description:	This program funds various buildings and grounds improvement projects: 1. Yard Improvements - Much needed CDD corporate yard improvements will address health, safety, reliability, and security issues; replacing obsolete and inefficient HVAC equipment; modernizing the main administration building including new SCADA monitors to operations room (gate room), Audiovisual conference room improvements and office renovations. 2. Fueling Station - The main underground fueling station has reached the end of its useful service life and is degrading: it will be replaced with an above-ground station. 3. CDD Control Center - Construction of a seismically reliable building to house CDD's communications and control systems. The building will house hardware, and operations, administrative & support staff.
Justification:	1. Yard Improvements - The current HVAC system is nearly 50 years old, inefficient and unreliable. The upgrades will improve efficiency, lower operating costs, heighten security and increase productivity; increase employee production and foster community and collaboration. 2. Fueling Station - Extensive internal tank corrosion discovered during routine fuel polishing could result in loss of fueling capabilities and adverse environmental impacts. Replacement will meet present and future needs for routine and emergency operations. Fuel usage will be tracked per vehicle and maintain critical data on consumption and mileage. Above ground tanks will manage the risk associated with environmental impacts. 3. CDD Control Center - Currently CDD's control, communication and network infrastructure for AWSS, Potable Water, Security and radio dispatch systems are in multiple locations that are seismically vulnerable. This phase will use 65% designs as a basis for a new facility that will house the hardware for the systems in a single seismically reliable building. This building will also house CDD's business network hardware and provide space for Operations, Administrative and Support staff.
Operating Impact:	1. Yard Improvements - The upgrade will result in a reduction in energy usage with a comparable reduction in operating and maintenance costs. 2. Fueling Station - Loss or reduction in fueling capabilities would severely impact routine and emergency operations to maintain the potable and auxiliary water systems. 3. CDD Control Center - This facility will greatly increase continuity of operations after a catastrophic event. The concentration of operations personnel in a single seismically reliable location will also increase efficiency.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 310	$ 210	$ 100	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 150	$ 50	$ 100	$ 0	$ 0	$ 0	$ 0
Total	**$ 460**	**$ 260**	**$ 200**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUWXXX
Project Title:	Local Water - New Service Connection Improvement Program - NEW - CUWXXX
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	
Asset Classification:	Candidates
Type:	Capital
Description:	The City is in the middle of a construction boom, resulting in an unprecedented increase in applications for new water service connections. This increased demand has taxed existing resources and processes, resulting in a sub-optimal customer experience. Customers regularly experience extended installation delays and difficulty tracking the status of new applications and installations. This project is aimed at re-engineering existing processes and deploying appropriate technology to deliver an excellent customer experience. Key objectives are: - Interview customers to develop an understanding of customer needs - Provide customers a single point of contact regarding all requests for new service connections, water, wastewater and power - Provide customers a comprehensive one-stop-shop for understanding the process for obtaining new service connections - Allow customers to apply` for new service connections online - Provide customers visibility into the application/installation process - Provide customers an accurate estimate of the cost of new installations - Be able to commit to installation dates that do not vary - Make the entire process for new service connections as streamlined as possible - Reduce backlog of new service connection requests - Reduce new installation wait time from x days to y days a z% reduction in wait time Additionally, this project is an opportunity to develop and refine key competencies to support the strategic plan goal of Organizational Excellence, in particular the following objectives: - Objective 1 foster continuous improvement across the agency - Objective 3 improve our operational efficiency through technology - Objective 6 provide responsive and efficient service to internal and external customers Specifically, this project provides an opportunity to enhance our ability to properly charter and execute a complex, cross-functional effort aimed at improving our customers' experience that involves the deployment of technology. The project has been underway since June 2016 with budgetary needs being supplied under CUW280 and consisting of project management resource support only. This cost proposal includes continued project management or process enhancement tasks and implementation of 2 new technology systems. The overall project estimate for that is $2,990,475.
Justification:	This project began in June 2016 under charter by 2 Assistant General Managers in response to continued customer complaints regarding the new water service application and installation processes.
Operating Impact:	The project results in streamlined operating processes and new technologies to provide transparency to projects.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 1,446	$ 499	$ 599	$ 348	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 1,544	$ 469	$ 778	$ 296	$ 0	$ 0	$ 0
Total	**$ 2,990**	**$ 968**	**$ 1,377**	**$ 644**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW26308
Project Title:	Local Water - Town of Sunol Pipeline - NEW - CUW26308
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	Chris Nelson
Asset Classification:	Water Transmission Program
Type:	Capital
Description:	The SFPUC completed the construction of a fire suppression system for the Town of Sunol through an MOU with Alameda County. The project constructed a fire suppression system including new pipelines, pump stations, monitoring equipment and storage tanks. For most of the Town of Sunol, the pipes combined both potable and fire hydrant service. The next phase of the project will replace a section of the pipeline that crosses the creek and under Hwy 680. 100% of this project is LOCALLY funded.
Justification:	The upstream section of pipeline that feeds both the potable line and fire suppression line is exposed under the creek and in danger of failing uder HWY 680. Pipeline failure at either location has significant consequences.
Operating Impact:	Reduced maintenance from pipe breaks and less main flushing may lower operating expenses. All fire and potable water in the TOS is dependent on the rehabilitation of this 12" line.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 200	$ 100	$ 100	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 200	$ 100	$ 100	$ 0	$ 0	$ 0	$ 0
Design	$ 300	$ 300	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 200	$ 200	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 2,500	$ 2,000	$ 500	$ 0	$ 0	$ 0	$ 0
Total	**$ 3,400**	**$ 2,700**	**$ 700**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW283_N03
Project Title:	Local Water - Lombard Geotechnical Improvements - NEW - CUW283_N03
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	Don Lampe
Asset Classification:	Water Supply and Storage Program
Type:	Capital
Description:	This project includes the design and construction of geotechnical improvements to the Northeast slope of the Lombard Reservoir. More specifically, the slope on the south side of Lombard Street from the intersection with Hyde Street extending approximately 200 feet west and on the west side of Hyde Street from the intersection with Lombard Street extending approximately 100 feet south.
Justification:	A recent consultant study of the slopes stability indicated the need to stabilize the slope to provide an adequate safety factor against failure.
Operating Impact:	Failure to mitigate the slopes stability could lead to premature failure of the slope during major rain events due to soil saturation.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 50	$ 50	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 25	$ 25	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 175	$ 0	$ 175	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 2,000	$ 0	$ 0	$ 2,000	$ 0	$ 0	$ 0
Total	**$ 2,250**	**$ 75**	**$ 175**	**$ 2,000**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUW688-N
Project Title:	Local Water - Additional Newcomb Yard Improvements - NEW - CUW688-N
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	Don Lampe
Asset Classification:	Buildings and Grounds Program
Type:	Capital
Description:	The City Distribution Division (CDD) Maintenance Yard (Newcomb Yard), a 30,000 square foot site, is located at 1990 Newcomb Avenue, San Francisco and was constructed in 1962. The buildings and facilities located at Newcomb Yard need full replacement because they do not meet life-safety standards for seismic events, do not meet building code requirements, and are outdated and past end-of-useful life. The Newcomb Yard facility is staffed by approximately 260 people and consists of three primary buildings. In 2017 a Condition Assessment of the Newcomb Yard facilities was performed and found all buildings to be aged, water-damaged, and deficient in meeting seismic, ADA, electric, and most other building codes. Several of the buildings, including the Administration Building where people work 24 hours per day, were found to not meet the minimum Life Safety Standard for seismic events, and may be expected to experience catastrophic failure during a large seismic event. Based upon the Condition Assessment, it was recommended that all buildings be rebuilt. A Needs Assessment was performed to determine facility requirements for the next 20 years. A Master Plan was developed to identify space and construction phasing alternatives to spread costs and allow partial building occupancy during construction. Based upon the Condition Assessment findings and Master Plan implementation alternatives, it is recommended to implement the Master Plan in four construction phases: namely Phase 1 Shops Building; Phase 2 Administration Building; Phase 3 Warehouse Facilities, and Phase 4 Parking Structure & Landscaping. While the Master Plan's vision is to rebuild all facilities, the four construction phases are defined to be independent and fully functional in the event that subsequent construction phases are delayed. The full design and build-out of all four construction phases is estimated to cost $160 million; the design and build-out of the Phase 1, Shops Building is estimated to cost $40 million. Phase 1 Permitting & Architecture will be coordinated with WWE's Southeast Facility improvements for cohesive strategy and appearance. Planning and permitting are anticipated for FY21, with Final Design in FY22, and construction during FY23 through FY26.
Justification:	Severe seismic, structural and other code deficiencies, coupled with water damage, unreliable electrical service, and outdated undersized work spaces, result in lower productivity, excessive building maintenance, and risk of injury during a seismic event. The CDD is a critical emergency response department, staffed 24 hours per day, responding to approximately 40 fires and 120 emergency main breaks annually, as well as variety of other major and minor water system emergencies. Following an earthquake, the Administration Building, where the Emergency Dispatcher resides, may collapse, and critical communication systems may be lost, as well as staff may be injured or killed. New buildings and facilities are needed to replace existing ones that have come to the end of their useful life. Implementation of Phase 1 of the Newcomb Yard Master Plan involves the design and construct of a new Shops Building (estimated cost of $34.0 million), construction of new subterranean electrical and utility rooms for the entire Newcomb Yard (estimated cost of $4.0 million) and construction of site improvements to facility vehicular & pedestrian access to the new Shops Building (estimated cost of $2.0 million). During the construction of Phase 1, CDD will continue to function without interruption because the existing Shops Building will not be decommissioned until the new Shops Building is fully operational.
Operating Impact:	Without improvements, following a seismic event or other natural disaster, the Newcomb Yard and buildings may be severely damaged, limiting or delaying the response capabilities of Emergency Response staff who are critical to maintaining and restoring water service. Rebuilding with new updated architecture will provide security, reliability, safety, and higher productivity for workers. The buildings will enhance the neighborhood and promote SFPUC's good-neighbor policy in the Bayview community.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 1,000	$ 0	$ 0	$ 1,000	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 39,000	$ 0	$ 0	$ 0	$ 13,000	$ 26,000	$ 0
Total	**$ 40,000**	**$ 0**	**$ 0**	**$ 1,000**	**$ 13,000**	**$ 26,000**	**$ 0**

Project FAMIS#:	CUWAW
Project Title:	Local Water - ESER - CUWAW
Enterprise:	Water Enterprise
Organization:	Local Water
Project Manager:	
Asset Classification:	Auxiliary Water Supply System
Type:	Capital
Description:	This program includes repairing, replacing, and extending system components of the Emergency Firefighting Water System, which delivers high-pressure water and provides cistern water storage for fire suppression in the City.
Justification:	This program is intended to increase the likelihood of providing fire-fighting water following a major earthquake and during multiple-alarm fires from other causes. The program continues implementation of the Earthquake Safety and Emergency Response (ESER) Bond programs with the assumed voter approval of a new ESER bond referendum in year 2020.
Operating Impact:	Lack of funding will cause delay in implementing the assumed referendum. Future bond funding is assumed to be $50 million in FY20-21 and $40 million in FY21-22.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 4,500	$ 0	$ 0	$ 2,500	$ 2,000	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 13,500	$ 0	$ 0	$ 7,500	$ 6,000	$ 0	$ 0
Construction Management	$ 18,000	$ 0	$ 0	$ 10,000	$ 8,000	$ 0	$ 0
Construction	$ 54,000	$ 0	$ 0	$ 30,000	$ 24,000	$ 0	$ 0
Total	**$ 90,000**	**$ 0**	**$ 0**	**$ 50,000**	**$ 40,000**	**$ 0**	**$ 0**

Project FAMIS#:	CUW25701
Project Title:	Regional Water - Watershed Protection - CUW25701
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Tim Ramirez
Asset Classification:	Watershed Protection Program
Type:	Programmatic
Description:	The purpose of this program is to support planning efforts for projects to improve and/or protect the water quality and/or ecological resources that affect or are affected by the operation of the SFPUC water supply system within the Bay Area counties. Examples of these projects include collaborative efforts with members of watershed workgroups, leading-edge research with local universities, and education programs with community groups. Many of these projects also include cost-share from project partners.
Justification:	This program provides the foundation for the long-term stewardship of natural resources under SFPUC management by supporting collaborative planning and environmental regulatory compliance efforts.
Operating Impact:	By providing for the long-term stewardship of natural resources and protection of water quality, this program will minimize the environmental regulatory risk and long-term costs associated with not proactively managing the natural resources that affect or are affected by the operation of the SFPUC water system. All projects are managed by existing Natural Resources and Lands Management Division staff.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 500	$ 50	$ 50	$ 50	$ 50	$ 50	$ 250
Construction	$ 4,600	$ 550	$ 450	$ 450	$ 450	$ 450	$ 2,250
Total	**$ 5,100**	**$ 600**	**$ 500**	**$ 500**	**$ 500**	**$ 500**	**$ 2,500**

Project FAMIS#:	CUW27101
Project Title:	Regional Water - WSIP-Related Mitigation & Monitoring - CUW27101
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Tim Ramirez
Asset Classification:	Long Term Monitoring
Type:	Programmatic
Description:	The purpose of this program is to meet the long-term monitoring and permit requirements associated with capital projects and the operation and maintenance of the SFPUC water supply system and watershed/ROW lands within the Bay Area. Projects with long-term monitoring required by environmental permits include the Alameda Watershed Habitat Conservation Plan, WSIP-related environmental mitigation and permit requirements (i.e., National Marine Fisheries Service) and non-WSIP capital projects.
Justification:	This program provides the resources to comply with terms and conditions in state and federal environmental permits associated with construction and/or operations and maintenance of the SFPUC water system, and watershed and ROW lands.
Operating Impact:	By providing the resources to comply with conditions and state and federal environmental regulatory permits, this program will minimize the risk and long-term costs associated with operation and maintenance of the SFPUC water supply system and watershed and ROW lands. As additional capital projects are completed, long-term monitoring funding will be requested as needed to meet conditions in state and federal environmental regulatory permits.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 122,406	$ 6,585	$ 11,201	$ 12,219	$ 12,761	$ 10,440	$ 69,200
Total	**$ 122,406**	**$ 6,585**	**$ 11,201**	**$ 12,219**	**$ 12,761**	**$ 10,440**	**$ 69,200**

Project FAMIS#:	FUW102
Project Title:	Regional Water - Watershed Structures Upgrades (culverts&fences) - FUW102
Enterprise:	Water Enterprise
Organization:	Regional Water
Project Manager:	Tim Ramirez
Asset Classification:	Water Enterprise Watershed Protection
Type:	Programmatic
Description:	The project involves culvert installation/replacement, slope stabilization, installation of erosion control, and security fencing/gate installation within the east and west bay watersheds. The purpose of this program is to support investments in natural resources and watershed and rights of way (ROW) related capital assets, including: roads, fences, culverts, stock ponds, and watershed cottages.
Justification:	Expenditures are required to maintain functioning structures for access to SFPUC water system infrastructure and lands. This program provides funding to support investments in watershed and ROW assets under SFPUC management, and improves the ability to cost-effectively manage access to and protect water system infrastructure by maintaining roads, fences, and bridges in good condition.
Operating Impact:	The project reduces miscellaneous repairs needed to access SFPUC infrastructure and lands. The project provides resources required for the long-term management of SFPUC watershed and ROW lands. Projects are the responsibility of existing Natural Resources and Lands Management Division and Water Supply and Treatment Division staff.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 960	$ 96	$ 96	$ 96	$ 96	$ 96	$ 480
Environmental Review	$ 480	$ 48	$ 48	$ 48	$ 48	$ 48	$ 240
Design	$ 1,920	$ 192	$ 192	$ 192	$ 192	$ 192	$ 960
Construction Management	$ 860	$ 86	$ 86	$ 86	$ 86	$ 86	$ 430
Construction	$ 7,740	$ 774	$ 774	$ 774	$ 774	$ 774	$ 3,870
Total	**$ 11,960**	**$ 1,196**	**$ 1,196**	**$ 1,196**	**$ 1,196**	**$ 1,196**	**$ 5,980**

SFPUC Capital Project Plan
Water Enterprise
Programmatic

Project FAMIS#:	CUW265
Project Title:	Programmatic - Landscape Conservation Program - CUW265
Enterprise:	Water Enterprise
Organization:	Programmatic
Project Manager:	Julie Ortiz
Asset Classification:	Program - Project
Type:	Programmatic
Description:	This program funds the following two water conservation projects: 1. Large Landscape Conservation Retrofit Program (CUW26501) that funds the replacement of old, water-wasting irrigation equipment and plantings at large landscapes in the SFPUC's retail service area. 2. Municipal Building Toilet Program (CUW26517) that funds replacement of old, water-wasting toilets and urinals in City facilities. Both programs are part of the SFPUC's Retail Water Conservation Plan that guides how the SFPUC will meet near- and long-term local and state water conservation goals and directives. Annual Large Landscape Conservation Retrofit Program funding covers approximately 3 to 4 projects a year, and annual Municipal Building Toilet Program funding covers replacement of approximately 1,000 fixtures. Municipal toilet and urinal replacements will end after 2018 when local code requires efficient fixtures. Large landscape retrofits are not restricted by code, are envisioned to continue, and the program overall will re-evaluated in five years.
Justification:	A feasibility study has been completed as part of CUW278. A new index code is being requested as the project progresses to environmental review and design for the benefit of regional customers of the Regional Water System (RWS).
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 5,000	$ 2,000	$ 2,000	$ 1,000	$ 0	$ 0	$ 0
Total	**$ 5,000**	**$ 2,000**	**$ 2,000**	**$ 1,000**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	FUW101
Project Title:	Programmatic - AWSS Maintenance - FUW101
Enterprise:	Water Enterprise
Organization:	Programmatic
Project Manager:	Katie Miller
Asset Classification:	Program - Project
Type:	Programmatic
Description:	The Auxiliary Water Supply System (AWSS) is a high-pressure water distribution system for fighting fires in San Francisco that was originally built between 1908 and 1913, and is in need of rehabilitation. Facilities include one storage reservoir, two storage tanks, two salt-water pump stations with intake tunnels, and approximately 135 miles of piping, 3,800 valves, 1,600 high pressure hydrants, and 177 underground storage cisterns. There also are 52 suction connections along the northeastern waterfront that allow fire engines to pump water from the San Francisco Bay and five manifolds that can be connected to fire boats to pump water from the bay. This project is intended to fund short term capital improvements needed to maintain system reliability, including rehabilitation of major pumps, pipes, valves, hydrants, equipment, tunnels, Supervisory Control and Data Acquisition (SCADA) controls, and other facilities necessary to maintain basic functional reliability. This program provides annual funding of $500K needed to maintain the functional reliability of the AWSS
Justification:	The Applied Technology Council (ATC) estimates building damages from a major earthquake due to shaking and fire at $16.3 billion to $37.9 billion in 2005 dollars. Fire damage would account for 20% to 50% of total earthquake damage, or about $8 billion in losses. If the AWSS fails to perform after an earthquake, the fire damage contribution may increase to as much as 80% of total earthquake losses.
Operating Impact:	Pump Station 2 needs to be automated to meet the Level of Service that the Pump Station is operating reliably within one hour of a major earthquake. To ensure this level of reliability, the Pump Station would need to be staffed 24/7, or have automated remote controls. The cost of automation is equivalent to about 8 years of full-time staffing; thus this pays for itself over time. It is not feasible to move current Operations staff from LMPS for this function since 24/7 staffing will also be required at LMPS to facilitate AWSS operations for Lake Merced pumps, as well as operate the potable water distribution system reliably.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 5,000	$ 500	$ 500	$ 500	$ 500	$ 500	$ 2,500
Total	**$ 5,000**	**$ 500**	**$ 500**	**$ 500**	**$ 500**	**$ 500**	**$ 2,500**

Project FAMIS#:	PUW502
Project Title:	Programmatic - Water Resource Planning and Development - PUW502
Enterprise:	Water Enterprise
Organization:	Programmatic
Project Manager:	Paula Kehoe
Asset Classification:	Program - Project
Type:	Programmatic
Description:	Building on the findings of the Water Supply Master Plan, the SFPUC completed and adopted a water supply program to meet future demand through 2018 as part of the Phased Water System Improvement Program (WSIP). The program includes developing 20 million gallons per day (mgd) of recycled water, conservation and/or groundwater in the retail and wholesale customer service areas. In addition, the SFPUC has projected a shortfall of available water supply to meet its level of service goals and contractual obligations. Staff will report water sales projections and progress toward meeting the 20 mgd goal annually. In 2011-12, the SFPUC continued studies on recycled water, groundwater projects, conservation and graywater in the SFPUC service area and regional desalination. Activities associated with implementation of this program in 2012-13, include updating water demand projections, conducting planning studies for additional recycled water, conservation and groundwater potential, continuing studies on dry-year water supplies and providing water supply impact analyses. Additionally, staff will study the potential water supply benefits from alternative water supplies, such as graywater, blackwater, stormwater and seepage water. Funding Allocation: 20% groundwater feasibility and resource management studies; 25% recycled water feasibility and planning studies; 35% hydrologic, climate change and demand management studies; and 20% alternative water supplies options.
Justification:	This information will be used to meet the SFPUC water supply program through 2018 and beyond. This program supports critical water supply planning necessary for implementing the Phased WSIP. In addition, in 2012 the SFPUC will be required to update its water supply plan to demonstrate how its water supply program will meet customer demand through 2035.
Operating Impact:	The water supply planning budget for FY 2012/13 is to support the implementation of the Phased WSIP Variant adopted by the Commission on October 30, 2008.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 1,500	$ 300	$ 300	$ 300	$ 300	$ 300	$ 0
Total	**$ 1,500**	**$ 300**	**$ 300**	**$ 300**	**$ 300**	**$ 300**	**$ 0**

Project FAMIS#:	PUW511 (WTR)
Project Title:	Programmatic - Treasure Island Facilities Maintenance - PUW511 (WTR)
Enterprise:	Water Enterprise
Organization:	Programmatic
Project Manager:	[None]
Asset Classification:	Program - Project
Type:	Programmatic
Description:	This project is for operating and maintaining the potable water distribution system at Treasure Island (TI) and Yerba Buena Island (YBI) on behalf of the Treasure Island Development Authority (TIDA). Potable water to TI/YBI is supplied by a transmission main from San Francisco and a backup supply from Oakland by the East Bay Municipal Utility District. The transmission mains from San Francisco and Oakland go to YBI via the western and eastern spans of the San Francisco-Oakland Bay Bridge, respectively. The potable water distribution system on TI/YBI is comprised of four reservoirs, six pump stations, and a distribution piping network. The water system operation is regulated by a water supply permit issued to the Navy by the California Department of Health Services.
Justification:	This programmatic project funds the routine maintenance required to keep the Water Facilities on Treasure Island functional. In addition this project also funds payment of the monthly water bills for all commercial and residential connections on the Island.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 14,557	$ 1,273	$ 1,311	$ 1,350	$ 1,390	$ 1,431	$ 7,802
Total	**$ 14,557**	**$ 1,273**	**$ 1,311**	**$ 1,350**	**$ 1,390**	**$ 1,431**	**$ 7,802**

SFPUC Capital Project Plan
Water Enterprise
Programmatic

Project FAMIS#:	PUW517
Project Title:	Programmatic - Retrofit Grant Program - PUW517
Enterprise:	Water Enterprise
Organization:	Programmatic
Project Manager:	
Asset Classification:	Program - Project
Type:	Programmatic
Description:	
Justification:	
Operating Impact:	

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 3,458	$ 1,134	$ 637	$ 257	$ 488	$ 507	$ 435
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 3,458**	**$ 1,134**	**$ 637**	**$ 257**	**$ 488**	**$ 507**	**$ 435**

Project FAMIS#:	PYEAES06 (WTR)
Project Title:	Programmatic - Youth Employment Project - PYEAES06 (WTR)
Enterprise:	Water Enterprise
Organization:	Programmatic
Project Manager:	Carol Isen
Asset Classification:	Program - Project
Type:	Programmatic
Description:	The Earth Stewards is a collaborative effort by the SFPUC, the San Francisco Sheriff's Department and the Garden Project to provide at-risk, young San Franciscans with horticultural and landscaping work experience on SFPUC properties. The program currently has capacity for 12 at-risk youth and develops an individualized 24-month program for each participant. Since inception, Earth Stewards Apprentices and Trainees participants have totaled 389. In the past the Earth Stewards have performed landscaping and maintenance services for the City Distribution Division (CDD), Hetch Hetchy, and Crystal Springs Reservoir.
Justification:	The project provides at-risk, young San Franciscans with work experience with the intent of reducing recidivism among ex-offenders and inmates of the San Francisco County Jail.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 12,900	$ 1,290	$ 1,290	$ 1,290	$ 1,290	$ 1,290	$ 6,450
Total	**$ 12,900**	**$ 1,290**	**$ 1,290**	**$ 1,290**	**$ 1,290**	**$ 1,290**	**$ 6,450**

Project FAMIS#:	PUW514 (WTR)
Project Title:	Programmatic - 525 Golden gate - Operations and Maintenance - PUW514 (WTR)
Enterprise:	Water Enterprise
Organization:	Programmatic
Project Manager:	[None]
Asset Classification:	525 Golden Gate
Type:	Programmatic
Description:	This project is required to cover annual operating and maintenance costs of the building and generally reflects an increase of 3.0% per year. These costs include building engineering, property management, janitorial and maintenance service contracts.
Justification:	The headquarters for the San Francisco Public Utilities Commission, 525 Golden Gate is a 13-story building plus basement for total building area of 277,500 square feet, which houses over 900 PUC employees. It is a LEED Platinum certified building that includes solar and wind renewable energy sources, an on-site wastewater system called the Living Machine, and Smart Building features with fully integrated systems.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 45,460	$ 5,277	$ 4,050	$ 4,064	$ 4,186	$ 4,311	$ 23,572
Total	**$ 45,460**	**$ 5,277**	**$ 4,050**	**$ 4,064**	**$ 4,186**	**$ 4,311**	**$ 23,572**

Project FAMIS#:	PUW515 (WTR)
Project Title:	Programmatic - 525 Golden Gate - Lease Payment - PUW515 (WTR)
Enterprise:	Water Enterprise
Organization:	Programmatic
Project Manager:	[None]
Asset Classification:	525 Golden Gate
Type:	Programmatic
Description:	This project provides financing to cover the planning and construction costs for the office building housing the SFPUC.
Justification:	The headquarters for the San Francisco Public Utilities Commission, 525 Golden Gate is a 13-story building plus basement for total building area of 277,500 square feet, which houses over 900 PUC employees. It is a LEED Platinum certified building that includes solar and wind renewable energy sources, an on-site wastewater system called the Living Machine, and Smart Building features with fully integrated systems. Under the terms of a Memorandum of Understanding between the City and the SFPUC dated 10/01/09, the SFPUC makes annual Base Rental Payments to the City for the building equal to annual debt service on the Certificates.
Operating Impact:	None.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 90,709	$ 9,168	$ 9,168	$ 9,169	$ 9,167	$ 9,169	$ 44,868
Total	**$ 90,709**	**$ 9,168**	**$ 9,168**	**$ 9,169**	**$ 9,167**	**$ 9,169**	**$ 44,868**

	A	B	C	D	E	F	G	H	I	J	K	L		M	N	O
1	USES	Remaining Balance as of 6/30/2017	FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	1	FY 18-27	FY 19-28	Change
2	**Hetch Hetchy Water**												2			
3	**Water Infrastructure**												3			
4	Water Conveyance (Water)	28,370,287	7,922,000	14,314,000	8,641,000	8,944,000	9,604,000	8,743,000	9,985,000	10,334,000	10,695,000	10,018,000	4	103,242,000	99,200,000	(4,042,000)
5	NEW - SJPL Valve and Safe Entry Improvement	-	3,575,000	2,691,000	2,445,000	34,102,000	26,567,000	25,904,000	-	-	-	-	5	-	95,284,000	95,284,000
6	NEW - Priest-Moccasin Water Transmission Line	-	-	5,600,000	5,768,000	31,326,000	-	-	-	-	-	-	6	-	42,694,000	42,694,000
7	Dams & Reservoirs (Water)	545,066	-	-	-	-	-	-	-	-	-	-	7	-	-	-
8	NEW - Moccasin Reservoir Perimeter Security Fence	-	1,400,000	3,755,000	-	-	-	-	-	-	-	-	8	-	5,155,000	5,155,000
9	NEW - Early Intake Dam Rehabilitation		-	-	-	-	-	1,249,000	3,434,000	-	-	-	9		4,683,000	4,683,000
10	Water Infrastructure Project Development	496,140	460,000	474,000	488,000	505,000	523,000	541,000	560,000	580,000	600,000	621,000	10	4,560,000	5,352,000	792,000
11	**Subtotal**	**29,411,493**	**13,357,000**	**26,834,000**	**17,342,000**	**74,877,000**	**36,694,000**	**36,437,000**	**13,979,000**	**10,914,000**	**11,295,000**	**10,639,000**	11	**107,802,000**	**252,368,000**	**144,566,000**
12	**Power Infrastructure**												12			
13	Water Conveyance (Power)	13,500,888	-	-	-	-	-	-	-	-	-	-	13	-	-	-
14	NEW - Moccasin Penstock Condition Assessment & AAR	-	-	1,000,000	-	-	-	-	-	-	-	-	14	-	1,000,000	1,000,000
15	Dams & Reservoirs (Power)	561,234	-	-	-	-	-	-	-	-	-	-	15	-	-	-
16	NEW - Priest Cond Assessment & Monitoring Project	-	-	-	2,000,000	-	-	-	-	-	-	-	16	-	2,000,000	2,000,000
17	NEW - Cherry-Eleanor Pumps	-	-	-	1,500,000	21,833,000	-	-	-	-	-	-	17	-	23,333,000	23,333,000
18	Powerhouse	6,006,250	1,000,000	1,039,000	1,080,000	1,119,000	1,158,000	1,198,000	1,239,000	1,282,000	1,327,000	1,373,000	18	-	11,815,000	11,815,000
19	NEW - Moccasin Powerhouse and GSU Rehabilitation	-	10,000,000	6,751,000	49,932,000	-	-	-	-	-	-	-	19	34,000,000	66,683,000	32,683,000
20	Roads & Bridges (Power)	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-
21	Switchyard & Substations	26,079,674	3,320,000	-	-	-	-	-	-	-	-	-	21	-	3,320,000	3,320,000
22	Transmission Lines	14,642,509	2,134,000	2,219,000	2,306,000	2,387,000	2,472,000	2,558,000	2,647,000	2,737,000	2,834,000	2,933,000	22	20,999,997	25,227,000	4,227,003
23	Power Infrastructure - Project Development	509,030	750,000	773,000	796,000	824,000	852,000	882,000	913,000	945,000	978,000	1,012,000	23	6,750,000	8,725,000	1,975,000
24	**Subtotal**	**61,299,585**	**17,204,000**	**11,782,000**	**57,614,000**	**26,163,000**	**4,482,000**	**4,638,000**	**4,799,000**	**4,964,000**	**5,139,000**	**5,318,000**	24	**61,749,997**	**142,103,000**	**80,353,003**
25	**Joint Infrastructure**												25			
26	Buildings												26	18,000,000		
27	Communications (Joint)	1,353,614	300,000	312,000	325,000	335,000	347,000	359,000	6,204,000	386,000	399,000	411,000	27	17,940,000	9,378,000	(8,562,000)
28	Dams & Reservoirs (Joint)	5,560,398	7,487,000	17,612,000	1,078,000	1,118,000	1,155,000	1,196,000	1,239,000	1,281,000	1,326,000	1,372,000	28	38,000,000	34,864,000	(3,136,000)
29	NEW - O'Shaughnessy Dam Outlet Works Phase II	-	-	-	-	-	-	14,460,000	14,893,000	82,870,000	-	-	29	-	112,223,000	112,223,000
30	NEW - Eleanor Dam Rehabilitation	-	-	-	-	-	-	8,960,000	24,618,000	-	-	-	30	-	33,578,000	33,578,000
31	Mountain Tunnel	9,012,366	19,566,000	41,540,000	50,000,000	50,000,000	50,000,000	-	-	-	-	-	31	619,630,000	211,106,000	(408,524,000)
32	Roads & Bridges (Joint)	2,776,985	1,800,000	1,873,000	1,949,000	2,017,000	2,088,000	2,161,000	2,484,000	3,216,000	3,327,000	1,515,000	32	19,600,000	22,430,000	2,830,000
33	NEW - Bridge Replacement	-	2,584,000	9,342,000	8,113,000	9,629,000	14,619,000	-	-	-	-	-	33	-	44,287,000	44,287,000
34	Tunnels (Joint)	1,029,588	-	880,000	7,000,000	-	-	-	-	-	-	-	34	5,500,000	7,880,000	2,380,000
35	Utilities (Joint)	1,089,282	-	-	-	-	-	-	-	-	-	-	35	-	-	-
36	NEW - R&R Power Distribution Improvements	-	1,000,000	1,031,000	1,500,000	1,560,000	1,622,000	1,679,000	1,738,000	1,799,000	1,862,000	1,927,000	36	-	15,718,000	15,718,000
37	Joint Infrastructure Project Development	414,032	2,000,000	2,060,000	2,122,000	2,196,000	2,273,000	2,352,000	2,435,000	2,520,000	2,608,000	2,700,000	37	18,000,000	23,266,000	5,266,000
38	**Subtotal**	**21,236,265**	**34,737,000**	**74,650,000**	**72,087,000**	**66,855,000**	**72,104,000**	**31,167,000**	**53,611,000**	**92,072,000**	**9,522,000**	**7,925,000**	38	**736,670,000**	**514,730,000**	**(203,940,000)**
39													39			
40	**HETCHY WATER TOTAL**	**111,947,343**	**65,298,000**	**113,266,000**	**147,043,000**	**167,895,000**	**113,280,000**	**72,242,000**	**72,389,000**	**107,950,000**	**25,956,000**	**23,882,000**	40	**906,221,997**	**909,201,000**	2,979,003
41	**Hetch Hetchy Power**												41			
42	**Streetlights**												42			
43	Various Streetlighting Replacements and Repairs	177,114	550,000	550,000	550,000	550,000	550,000	550,000	550,000	550,000	550,000	550,000	43	4,400,000	5,500,000	1,100,000
44	Various Streetlighting Area Improvements	130,733	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	44	10,000,000	10,000,000	-
45	High Voltage 5 KV Series Loop Conversion	2,472,442	1,500,000	1,500,000	1,500,000	1,500,000	-	-	-	-	-	-	45	6,000,000	6,000,000	-
46	Pedestrian Lighting Project	-	960,000	960,000	960,000	960,000	960,000	960,000	960,000	960,000	960,000	960,000	46	9,100,000	9,600,000	500,000
47	Holiday and Festivity Pole Use	190,394	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	47	2,000,000	2,000,000	-
48	Street and Pedestrian Light Pole Assessment	111,698	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	48	4,970,000	5,000,000	30,000
49	Streetlights Pole Rehabilitation	1,445,751	1,000,000	1,000,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	49	6,300,000	6,000,000	(300,000)
50	Distributed Antenna System	140,942	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	50	-	3,000,000	3,000,000
51	**Subtotal**	**4,669,074**	**6,010,000**	**6,010,000**	**5,510,000**	**5,510,000**	**4,010,000**	**4,010,000**	**4,010,000**	**4,010,000**	**4,010,000**	**4,010,000**	51	**42,770,000**	**47,100,000**	**4,330,000**
52	**Renewable and Generation**												52			
53	GoSolarSF Program (Sustainable Energy Account)	6,472,465	-	-	-	-	-	-	-	-	-	-	53	-	-	-
54	Renewable/Generation - Small Renewables	5,564,558	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	54	10,000,000	10,000,000	-
55	Renewable/Generation - Small Hydro	409,433	-	-	-	-	-	-	-	-	-	-	55	1,000,000	-	(1,000,000)
56	**Subtotal**	**12,446,456**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	56	**11,000,000**	**10,000,000**	**(1,000,000)**

	A	B	C	D	E	F	G	H	I	J	K	L		M	N	O
1	USES	Remaining Balance as of 6/30/2017	FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	1	FY 18-27	FY 19-28	Change
57	**Redevelopment**												57			
58	New Underground 12 kV Distribution System in TI and Y	-	1,894,844	1,707,065	1,482,543	1,482,543	1,482,543	1,482,543	1,482,543	1,482,543	1,204,034	1,204,034	58	10,500,000	14,905,235	4,405,235
59	New Underground 12 kV Distribution System in Oakland	-	-	-	3,100,000	2,850,000	-	-	-	-	-	-	59	5,950,000	5,950,000	-
60	Treasure Island Utility Setup Cost	10,615,423	-	-	-	-	-	1,250,000	-	-	-	-	60	1,250,000	1,250,000	-
61	HP Phase 2 - Alice Griffith/Candlestick Point	9,000,000	8,673,908	7,814,332	5,566,778	5,566,778	5,566,778	5,566,778	5,566,778	1,116,901	1,116,901	1,116,901	61	5,000,000	47,672,833	42,672,833
62	EE Programs for New Retail Customers	928,519	-	-	-	-	-	-	-	-	-	-	62	-	-	-
63	Transbay Transit Center	1,202,763	3,100,000	-	-	-	-	-	-	-	-	-	63	-	3,100,000	3,100,000
64	**Subtotal**	**21,746,705**	**13,668,752**	**9,521,397**	**10,149,321**	**9,899,321**	**7,049,321**	**8,299,321**	**7,049,321**	**2,599,444**	**2,320,935**	**2,320,935**	64	**22,700,000**	**72,878,068**	**50,178,068**
65	**Transmission/Distribution**												65			
66	SFO Substation Improvements		2,070,000	8,550,000					-	-	-		66		10,620,000	10,620,000
67	Intervening Facilities		9,950,000	9,950,000	9,950,000	9,950,000	9,950,000	9,950,000	9,950,000	9,950,000	9,950,000	9,950,000	67		99,500,000	99,500,000
68	Bay Corridor Transmission Distribution (BCTD)	14,735,364	20,000,000	21,000,000	5,000,000	5,000,000	5,000,000	-	-	-	-	-	68	20,000,000	56,000,000	36,000,000
69	Distribution Interface - New Customers	932,759	7,800,000	7,000,000	4,633,222	4,633,222	4,633,222	4,633,222	4,633,222	9,083,099	9,083,099	9,083,099	69	-	65,215,407	65,215,407
70	**Subtotal**	**15,668,123**	**39,820,000**	**46,500,000**	**19,583,222**	**19,583,222**	**19,583,222**	**14,583,222**	**14,583,222**	**19,033,099**	**19,033,099**	**19,033,099**	70	**20,000,000**	**231,335,407**	**211,335,407**
71	**Energy Efficiency**												71			
72	Cap and Trade	6,147,578	-	-	-	-	-	-	-	-	-	-	72	-	-	-
73	Civic Center Sustainability District	2,414,681	-	-	-	-	-	-	-	-	-	-	73	300,000	-	(300,000)
74	Energy Efficiency General Fund	1,997,273	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	74	9,700,000	10,000,000	300,000
75	**Subtotal**	**10,559,532**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	**1,000,000**	75	**10,000,000**	**10,000,000**	**-**
76													76			
77	**HETCHY POWER TOTAL**	**65,089,890**	**61,498,752**	**64,031,397**	**37,242,543**	**36,992,543**	**32,642,543**	**28,892,543**	**27,642,543**	**27,642,543**	**27,364,034**	**27,364,034**	77	**106,470,000**	**371,313,475**	264,843,475
78													78			
79	**Total USES**		**126,796,752**	**177,297,397**	**184,285,543**	**204,887,543**	**145,922,543**	**101,134,543**	**100,031,543**	**135,592,543**	**53,320,034**	**51,246,034**	79	**1,012,691,997**	**1,280,514,475**	**267,822,478**
80													80			
81	SOURCES		FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	81	FY 18-27	FY 19-28	Change
82	Revenue												82			
83	Power Revenue		42,168,752	38,221,397	26,538,543	26,253,543	21,867,543	18,081,543	16,788,543	16,744,543	16,417,034	16,365,034	83	181,300,329	239,446,475	58,146,146
84	Distributed Antenna System		300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	84	-	3,000,000	3,000,000
85	Power Fund Balance (Project close outs)		-	-	-	-	-	-	-	-	-	-	85	2,000,000	-	(2,000,000)
86	**Subtotal**		**42,468,752**	**38,521,397**	**26,838,543**	**26,553,543**	**22,167,543**	**18,381,543**	**17,088,543**	**17,044,543**	**16,717,034**	**16,665,034**	86	**183,300,329**	**242,446,475**	**59,146,146**
87	Debt												87			
88	Water Bonds		28,988,650	60,426,500	49,781,150	104,961,750	69,140,800	50,462,150	38,103,950	52,346,400	15,579,900	14,205,250	88	439,303,500	483,996,500	44,693,000
89	Power Bonds		54,339,350	77,349,500	107,211,850	72,883,250	54,089,200	31,729,850	44,235,050	65,553,600	20,326,100	19,626,750	89	381,988,168	547,344,500	165,356,332
90	**Subtotal**		**83,328,000**	**137,776,000**	**156,993,000**	**177,845,000**	**123,230,000**	**82,192,000**	**82,339,000**	**117,900,000**	**35,906,000**	**33,832,000**	90	**821,291,668**	**1,031,341,000**	**210,049,332**
91	Other												91			
92	Power - Cap and Trade Auction Revenue		1,000,000	1,000,000	454,000	489,000	525,000	561,000	604,000	648,000	697,000	749,000	92	8,100,000	6,727,000	(1,373,000)
93	**Subtotal**		**1,000,000**	**1,000,000**	**454,000**	**489,000**	**525,000**	**561,000**	**604,000**	**648,000**	**697,000**	**749,000**	93	**8,100,000**	**6,727,000**	**(1,373,000)**
87													87			
88	**Total SOURCES**		**126,796,752**	**177,297,397**	**184,285,543**	**204,887,543**	**145,922,543**	**101,134,543**	**100,031,543**	**135,592,543**	**53,320,034**	**51,246,034**	88	**1,012,691,997**	**1,280,514,475**	**267,822,478**
89													89			
90	**Surplus/ (Shortfall)**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	90	**-**	**-**	-
91													91			
92	Projects with funding reduced or funding eliminated and candidates not recommended for funding												92			
93	**Hetchy Water - Power Infrastructure**												93			
94	Kirkwood Penstock Rehabilitation		-	-	-	-	-	-	-	1,294,000	1,332,000	7,414,000	94	-	10,040,000	10,040,000
95	Holm Powerhouse - Cherry Creek Channel		-	-	1,000,000	2,602,000	-	-	-	-	-	-	95	-	3,602,000	3,602,000
96	Kirkwood Powerhouse Balance of the Plant		-	-	-	-	-	-	-	-	4,851,000	13,326,000	96	-	18,177,000	18,177,000
97	Holm Penstock Condition Assessment		-	-	-	876,000	2,404,000	-	-	-	-	-	97	-	3,280,000	3,280,000
98	Holm Bridge Replacement		-	-	-	-	-	2,412,000	6,627,000	-	-	-	98	-	9,039,000	9,039,000
99	Moccasin Switchyard Rehabilitation		-	-	-	-	2,416,000	6,637,000	-	-	-	-	99	-	9,053,000	9,053,000
100	**Hetchy Water - Joint Infrastructure**												100			
101	Buildings		2,000,000	2,084,000	2,715,000	3,707,000	3,838,000	3,834,000	5,155,000	3,872,000	4,008,000	4,146,000	101		35,359,000	35,359,000
102	Moccasin Yard Improvements Phase II		9,764,000	10,202,000	51,307,000	-	-	-	-	-	-	-	102	-	71,273,000	71,273,000
103	Moccasin to Modesto Communication Fiber		-	-	-	-	-	-	-	-	4,780,000	13,136,000	103	-	17,916,000	17,916,000
104	Cherry Dam Spillway		-	13,946,000	3,058,000	127,801,000	3,396,000	3,498,000	-	-	-	-	104	-	151,699,000	151,699,000
105	Moccasin Wastewater Treatment Plant		-	-	-	2,152,000	5,914,000	-	-	-	-	-	105	-	8,066,000	8,066,000
106	**Hetchy Power**												106			
107	SFO Substation Improvements								35,000,000	30,000,000	30,000,000		107	-	95,000,000	95,000,000
108	Bay Corridor Transmission Distribution (BCTD)		80,000,000	4,000,000	15,000,000	25,000,000	10,000,000	-	-	-	-	-	108	-	134,000,000	134,000,000
109	Distribution Interface - New Customers		39,251,673	39,088,518	21,609,257	9,734,253	9,363,159	5,770,174	3,832,383	-	-	-	109	-	128,649,417	128,649,417
110	HHP-EE Programs for New Retail Customers		2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	110	-	20,000,000	20,000,000
111			**121,251,673**	**45,088,518**	**38,609,257**	**36,734,253**	**21,363,159**	**7,770,174**	**40,832,383**	**32,000,000**	**32,000,000**	**2,000,000**	111		**377,649,417**	**377,649,417**

	A	B	C	D	E	F	G	H	I	J	K	L		M	N	O
1	**USES**	**Available Balance as of 6/30/2017**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**	**FY 23-24**	**FY 24-25**	**FY 25-26**	**FY 26-27**	**FY 27-28**	1	**FY 18-27**	**FY 19-28**	**Change**
2	**Program - Project**												2			
3	SF Electric Reliability-Trans Bay Cable Funding	6,243,502	2,000,000	2,000,000	2,000,000	-	-	-	-	-	-	-	3	8,000,000	6,000,000	(2,000,000)
4	Facilities Maintenance	36,201	2,541,000	2,617,000	2,695,000	2,775,000	2,858,000	2,943,000	3,031,000	3,121,000	3,214,000	3,310,000	4	25,410,000	29,105,000	3,695,000
5	HHW-WECC/NERC Compliance	589	3,700,000	3,700,000	3,700,000	3,700,000	3,700,000	3,700,000	3,700,000	3,700,000	3,700,000	3,700,000	5	37,000,000	37,000,000	-
6	HHW-WECC/NERC Transmission Line Clearance	499,303	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	6	2,000,000	2,000,000	-
7	Treasure Island Facilities Maintenance	93,382	3,469,000	3,643,000	3,825,000	4,016,000	4,217,000	4,428,000	4,649,000	4,788,000	4,930,000	5,077,000	7	39,580,000	43,042,000	3,462,000
8	Community Benefits-Water	386,683	-	-	-	-	-	-	-	-	-	-	8	-	-	-
9	Community Benefits-Power	239,016	-	-	-	-	-	-	-	-	-	-	9	-	-	-
10	Youth Employment Project	-	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	10	1,500,000	1,500,000	-
11	**Subtotal**	7,498,676	**12,060,000**	**12,310,000**	**12,570,000**	**10,841,000**	**11,125,000**	**11,421,000**	**11,730,000**	**11,959,000**	**12,194,000**	**12,437,000**	11	**113,490,000**	**118,647,000**	**5,157,000**
12													12			
13	525 Golden Gate - Operations & Maintenance	141,170	971,200	752,720	756,000	779,000	802,000	826,000	850,000	850,000	850,000	875,000	13	7,698,000	8,311,920	613,920
14	526 Golden Gate - Lease Payments	2,719,323	1,248,000	1,248,000	1,248,000	1,248,000	1,248,000	1,243,000	1,243,000	1,232,000	1,222,000	1,212,000	14	12,465,000	12,392,000	(73,000)
15	**Subtotal**	2,860,493	2,219,200	2,000,720	2,004,000	2,027,000	2,050,000	2,069,000	2,093,000	2,082,000	2,072,000	2,087,000	15	20,163,000	20,703,920	540,920
16													16			
17	**Total USES**	**10,359,169**	**14,279,200**	**14,310,720**	**14,574,000**	**12,868,000**	**13,175,000**	**13,490,000**	**13,823,000**	**14,041,000**	**14,266,000**	**14,524,000**	17	**133,653,000**	**139,350,920**	5,697,920
18													18			
19													19			
20													20			
21	**SOURCES**	**Available Balance as of 6/30/2017**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**	**FY 23-24**	**FY 24-25**	**FY 25-26**	**FY 26-27**	**FY 27-28**	21	**FY 18-27**	**FY 19-28**	**Change**
22	**Other**										238000	238000	22	238000	238000	238000
23	Infrastructure - Recovery Capital (O&M)		107,000	83,000	84,000	86,000	88,000	90,000	3,469,000	3,643,000	3,825,000	4,016,000	23	4,428,000	4,649,000	4,788,000
24	Federal Bond Interest Subsidy		265,000	265,000	265,000	265,000	265,000	265,000	8,200,200	8,081,720	8,162,000	8,263,000	24	8,469,000	8,586,000	8,674,000
25	Trans Bay Cable Payment		2,000,000	2,000,000	2,000,000	-	-	-	-	-	-	-	25	10,000,000	6,000,000	4,000,000
26	Infrastructure - Recovery Capital (Lease)		238,000	238,000	238,000	238,000	238,000	238,000	238,000	238,000	238,000	238,000	26	2,380,000	2,380,000	-
27	**Subtotal**		**2,610,000**	**2,586,000**	**2,587,000**	**589,000**	**591,000**	**593,000**	**11,907,200**	**11,962,720**	**12,225,000**	**12,517,000**	27	**25,277,000**	**58,167,920**	**17,462,000**
28	**Revenue**												28			
29	Treasure Island		3,469,000	3,643,000	3,825,000	4,016,000	4,217,000	4,428,000	4,649,000	4,788,000	4,930,000	5,077,000	29	39,580,000	43,042,000	3,462,000
30	Revenue		8,200,200	8,081,720	8,162,000	8,263,000	8,367,000	8,469,000	(2,733,200)	(2,709,720)	(2,889,000)	(3,070,000)	30	68,796,000	38,141,000	(30,655,000)
31	**Subtotal**		**11,669,200**	**11,724,720**	**11,987,000**	**12,279,000**	**12,584,000**	**12,897,000**	**1,915,800**	**2,078,280**	**2,041,000**	**2,007,000**	31	**108,376,000**	**81,183,000**	**(30,655,000)**
32													32			
33	**Total SOURCES**		**14,279,200**	**14,310,720**	**14,574,000**	**12,868,000**	**13,175,000**	**13,490,000**	**13,823,000**	**14,041,000**	**14,266,000**	**14,524,000**	33	**133,653,000**	139,350,920	5,697,920
34													34			
35	Surplus / (Shortfall)		-	-	-	-	-	-	-	-	-	-	35	-	-	-

Hetch Hetchy Enterprise

Fiscal Year 2019-2028

Ten Year CIP

January 25, 2018

Project FAMIS#:	CUH100 Conveyance
Project Title:	Hetch Hetchy Water - Water Conveyance (Water) - CUH100 Conveyance
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Jimmy Leong
Asset Classification:	Water Infrastructure
Type:	Capital
Description:	This sub-program consists of projects intended to enhance the reliability of water delivery through pipelines. It encompasses San Joaquin Pipeline Life Extension program and Safe Entry program to extend the life, and to enhance safety and maintainability of the assets. It also includes a new candidate project Priest-Moccasin Water Transmission Line to build a new pipeline system to bypass the Moccasin Powerhouse so that water delivery will not be adversely impacted by the failure of power generating units which have reached their design life.
Justification:	This project is required to meet the Water Levels of Service for Regional Delivery, Water Supply and Sustainability.
Operating Impact:	If the conveyance system is not properly maintained and improved, there is a potential loss of reliable water delivery.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 14,582	$ 850	$ 3,871	$ 1,103	$ 1,142	$ 1,226	$ 6,390
Environmental Review	$ 13,984	$ 1,659	$ 4,245	$ 1,344	$ 878	$ 943	$ 4,915
Design	$ 21,026	$ 3,939	$ 2,812	$ 8,482	$ 791	$ 849	$ 4,153
Construction Management	$ 17,947	$ 993	$ 494	$ 509	$ 7,791	$ 2,918	$ 5,242
Construction	$ 169,639	$ 4,056	$ 11,183	$ 5,416	$ 63,770	$ 30,235	$ 54,979
Total	**$ 237,178**	**$ 11,497**	**$ 22,605**	**$ 16,854**	**$ 74,372**	**$ 36,171**	**$ 75,679**

Project FAMIS#:	CUH100 Dam & Res
Project Title:	Hetch Hetchy Water - Dams & Reservoirs (Water) - CUH100 Dam & Res
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Jimmy Leong
Asset Classification:	Water Infrastructure
Type:	Capital
Description:	This sub-program consists of two candidate projects that are associated with dams and reservoirs for storage and delivery of water to SFPUC customers: 1. Moccasin Reservoir Security Fence: HHWP will install an approximately 6,500 feet long perimeter security fence system around Moccasin Reservoir to discourage trespassers and minimize access by animals. The fence will help protect the quality of water supply to the Bay Area. Fence monitoring alarms, signs, lighting, and security camera will be considered as part of the design. 2. Early Intake Dam Rehabilitation: Early Intake Dam is a single-curvature concrete arch structure constructed between 1923 and 1924 to divert Hetch Hetchy water from the Tuolumne River into Mountain Tunnel. The dam is reaching the end of its design life, with significant cracking observed throughout the dam and spillway. Cracking is likely caused by Alkali Aggregate Reduction (AAR) and the resultant internal expansion of the concrete. An intermediate repair option is to install a Carpi Dam Liner on the upstream face of the dam to reduce the rate of expansion and deterioration caused by the AAR. This less expensive repair will extend the useful life of the dam by 20-25 years.
Justification:	These projects are required to meet the Water Levels of Service for Regional Delivery Reliability and Water Supply. In addition, the SPFUC is legally and ethically responsible to develop and maintain mature dam safety management program.
Operating Impact:	These projects are needed to help ensure the quality of water to the SFPUC customers. The Moccasin Reservoir Security Fence is required to protect water quality. The Early Intake Dam is required to divert water from the Tuolumne River or from Lower Cherry Aqueduct into Mountain Tunnel for the water delivery system in the event of drought, or failure of the O'Shaughnessy diversion works, Canyon Tunnel, Kirkwood Penstock or Intake Bypass.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 662	$ 350	$ 0	$ 0	$ 0	$ 0	$ 312
Environmental Review	$ 662	$ 350	$ 0	$ 0	$ 0	$ 0	$ 312
Design	$ 1,325	$ 700	$ 0	$ 0	$ 0	$ 0	$ 625
Construction Management	$ 975	$ 0	$ 515	$ 0	$ 0	$ 0	$ 460
Construction	$ 6,214	$ 0	$ 3,240	$ 0	$ 0	$ 0	$ 2,974
Total	**$ 9,838**	**$ 1,400**	**$ 3,755**	**$ 0**	**$ 0**	**$ 0**	**$ 4,683**

Project FAMIS#:	CUH100PD
Project Title:	Hetch Hetchy Water - Water Infrastructure Project Development - CUH100PD
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Jimmy Leong
Asset Classification:	Water Infrastructure
Type:	Capital
Description:	The Project Development (PD) Account captures Program level expenditures. There are four types of charges that will be allocated to the PD Account: 1. Task orders for overall program management and project prioritization tasks, where the costs should be distributed over all CIP Projects. 2. Infrastructure and Hetchy staff performing program level tasks including: capital plan development, budget management (including fund management, and cost reallocations); and Quarterly Report generation tasks, where the costs should be distributed over all CIP Projects. 3. Portal support for the existing SharePoint Portal (includes document management and project dashboard reporting). 4. Work Outreach program.
Justification:	The Project Development Account (PD Account) funds the capital improvement administrative staff, the project management staff and the professional services that could not be defined to one project detail as the charges would span across the overall program.
Operating Impact:	Programmatic support is an integral part of the capital program.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 5,352	$ 460	$ 474	$ 488	$ 505	$ 523	$ 2,902
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 5,352**	**$ 460**	**$ 474**	**$ 488**	**$ 505**	**$ 523**	**$ 2,902**

Project FAMIS#:	CUH101 Conveyance
Project Title:	Hetch Hetchy Water - Water Conveyance (Power) - CUH101 Conveyance
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Tim Parkan
Asset Classification:	Power Infrastructure
Type:	Capital
Description:	This sub-program consists of the following candidate project for assets associated with the conveyance of water that is critical for water supply to the Bay Area and for power generation: 1. Moccasin Penstock Condition Assessment & Alternative Analysis Report: Moccasin Penstock was built in the early 1920's and conveys Hetch Hetchy water from Moccasin Tunnel to Moccasin Powerhouse. Moccasin Penstock has many deficiencies and has served its life expectancy. Phase I work on Moccasin Penstock U1 is funded under the current Capital Plan. This candidate project will be to conduct a condition assessment of the asset to determine additional project needed to extend the life of this asset.
Justification:	This project is needed to meet Water Levels of Service objectives for Regional Delivery Reliability and Water Supply. The asset is a part of the SFPUC Water System and conveys water to Moccasin Powerhouse, resulting in power generation. This project is required to extend the useful life of the asset.
Operating Impact:	Failure of the Moccasin Penstock will impact HHWP's ability to deliver water that meets filtration avoidance criteria, and the ability to generate power. In addition, failure of the Moccasin Penstock would cause flooding, jeopardizing the safety of HHWP employees in Moccasin as well as damage to Moccasin facilities.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 1,000	$ 0	$ 1,000	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 1,000**	**$ 0**	**$ 1,000**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUH101 Dam & Res
Project Title:	Hetch Hetchy Water - Dams & Reservoirs (Power) - CUH101 Dam & Res
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Tim Parkan
Asset Classification:	Power Infrastructure
Type:	Capital
Description:	This sub-program consists of two candidate projects associated with dams and reservoirs for water storage and power generation: 1. Priest Reservoir Condition Assessment and Monitoring: Priest Dam is an earth and rock filled dam located just east of Moccasin, CA. The dam was built between 1921 and 1923 and has a long history of issues related to settlement and deflection. This candidate project will include a condition assessment and update the stability analysis of the dam using current standards and analysis techniques. New instrumentation will be installed to monitor and document the movements for the subsequent analysis. The results will be used to determine whether a future capital improvement project is required. 2. Cherry Eleanor Pumps: HHWP diverts approximately 110,000 acre-feet of water annually from Lake Eleanor to Cherry Reservoir, resulting in an additional 220GWh annually (about 13% of the HHWP annual generation). Six out of ten pumps are inoperable and the remaining four pumps are at continued risk of failure. The objective of this project is to replace and upgrade the pumps in Cherry Pump Station with units that work with current operating strategies. The scope of work includes: replacement of pumps, transformer, and pump motor starters, installation of Programmable Logic Controller (PLC), SCADA system, and fiber optics; and, improvement of the existing Motor Control Center (MCC) building.
Justification:	Priest Reservoir is a vital component of the HHWP water delivery and power generation systems, while water from Cherry Reservoir enables cost-effective generation of hydropower for HHWP at Holm Powerhouse. In addition, the SPFUC is legally and ethically responsible to develop and maintain mature dam safety management program.
Operating Impact:	For Priest Dam, the continual settlement and deflection may result in a restriction of the reservoir elevation, reducing storage capacity. For the Cherry Eleanor Pumps, the inability to operate all units at Cherry Pump Station results in loss of potential power generation at Holm Powerhouse.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 1,700	$ 0	$ 0	$ 1,700	$ 0	$ 0	$ 0
Environmental Review	$ 300	$ 0	$ 0	$ 300	$ 0	$ 0	$ 0
Design	$ 1,500	$ 0	$ 0	$ 1,500	$ 0	$ 0	$ 0
Construction Management	$ 7,725	$ 0	$ 0	$ 0	$ 7,725	$ 0	$ 0
Construction	$ 14,108	$ 0	$ 0	$ 0	$ 14,108	$ 0	$ 0
Total	**$ 25,333**	**$ 0**	**$ 0**	**$ 3,500**	**$ 21,833**	**$ 0**	**$ 0**

Project FAMIS#:	CUH101 PH & Penst
Project Title:	Hetch Hetchy Water - Powerhouse - CUH101 PH & Penst
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Tim Parkan
Asset Classification:	Power Infrastructure
Type:	Capital
Description:	This sub-program includes funding for capital improvements associated with Kirkwood, Moccasin, and Holm Powerhouses. The sub-program consists of one existing project and one candidate project that fall under the following scopes of work: 1. Moccasin Powerhouse and GSU Rehabilitation: Many of the systems have exceeded their life expectancy at Moccasin Powerhouse. This candidate project increases capital funding system improvements to the high voltage breakers, generator rehabilitation, switchgear, Motor Control Centers (MCCs), electrical protection, bypass valve system, step up transformers, vibration monitoring system and other auxiliary systems. 2. The R&R Powerhouses is an existing project that allocates funding to make improvements to the individual components of auxiliary systems or sub-systems in the powerhouses in order to maintain safety, regulatory compliance and effective operations of the powerhouses.
Justification:	The Moccasin and Kirkwood Powerhouses are vital components of the HHWP water delivery system to the SFPUC customers. These projects are also required to ensure that HHWP will continue to meet Operational Objectives for Power. Many of the powerhouse systems have reached the end of their expected life and require replacement and/or rehabilitation to prevent unplanned outages.
Operating Impact:	Failure to maintain these assets could result in reduced power generation from the three powerhouses, and reduced water deliveries (Kirkwood and Moccasin Powerhouses only).

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 3,677	$ 2,934	$ 72	$ 74	$ 77	$ 80	$ 440
Environmental Review	$ 1,631	$ 888	$ 72	$ 74	$ 77	$ 80	$ 440
Design	$ 7,947	$ 6,458	$ 144	$ 149	$ 154	$ 159	$ 883
Construction Management	$ 8,312	$ 100	$ 854	$ 6,503	$ 110	$ 114	$ 631
Construction	$ 56,931	$ 620	$ 6,648	$ 44,212	$ 701	$ 725	$ 4,025
Total	**$ 78,498**	**$ 11,000**	**$ 7,790**	**$ 51,012**	**$ 1,119**	**$ 1,158**	**$ 6,419**

Project FAMIS#:	CUH101 SY & Substn
Project Title:	Hetch Hetchy Water - Switchyard & Substations - CUH101 SY & Substn
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Tim Parkan
Asset Classification:	Power Infrastructure
Type:	Capital
Description:	This sub-program provides funds to meet HHWP's Operational Objectives for Power including Power System Reliability, Regulatory Compliance and Sustainability. It consists of the following existing project associated with switchyards and substations along the Hetchy power system: 1. Early Intake Switchyard Slope Hazard Mitigation: Early Intake Switchyard (ISY) is a 230 kV switchyard located alongside the Tuolumne River, downstream of HHWP's Kirkwood Powerhouse. The switchyard is a critical HHWP asset that provides the transmission of electrical power generated at Kirkwood and Holm powerhouses to Moccasin. The purpose of the project is to reduce the risk of slope failure which may cause damage to the switchyard and loss of power transmission capability to the City. Following the 2013 Rim Fire, the City applied and was granted a FEMA Hazard Mitigation Grant. This project will fund the remaining design and construction phases.
Justification:	This project is required to meet HHWP's Operational Objectives for Power including Power System Reliability, Regulatory Compliance and Sustainability. The Early Intake Switchyard is a critical facility that provides the transmission of electrical power generated at Kirkwood and Holm powerhouses to Moccasin as well as the local distribution of power to HHWP's upcountry facilities.
Operating Impact:	Impacts include a potential safety liability to the public and HH personnel. Also, a major slope failure could damage switchyard equipment causing a fault and knocking Holm Powerhouse or Kirkwood Powerhouse off line.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 200	$ 200	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 300	$ 300	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 400	$ 400	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 420	$ 420	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 2,000	$ 2,000	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 3,320**	**$ 3,320**	**$ 0**	**$ 0**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUH101 Trans Lines
Project Title:	Hetch Hetchy Water - Transmission Lines - CUH101 Trans Lines
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Mike Vroman
Asset Classification:	Power Infrastructure
Type:	Capital
Description:	This sub-program consists of projects for transmission lines 5/6, 7/8 and 3/4, as well as the distribution system. This includes reliability projects, as well as projects to address North American Electric Reliability (NERC) requirements, such as resolution of clearance discrepancies through system modifications like raising towers, grading or installing new conductor or insulators, as well as management of vegetation. The distribution system includes distribution lines, dry transformers, distribution substations, disconnect switches, breakers, protection, and metering. This sub-program also includes the assessment of system components, development of projects, prioritization, scheduling of high priority projects under R&R and CIP - Emergency Response Plan, and development of an emergency response plan, including procedures for renewal/replacement and a list of available contractors.
Justification:	Execution of selected mitigations will prevent more costly future repairs, reduce potential for catastrophic failure, and address safety concerns. Safety concerns are a risk to both the SFPUC employee and the public.
Operating Impact:	Safety and liability. Implementation of clearance mitigations and power system upgrades will prevent the need for future extended outages. Select repair alternatives can be performed with little to no required outages if properly planned and executed.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 1,244	$ 107	$ 111	$ 113	$ 118	$ 121	$ 674
Environmental Review	$ 1,989	$ 171	$ 176	$ 182	$ 188	$ 195	$ 1,077
Design	$ 2,059	$ 177	$ 182	$ 188	$ 194	$ 202	$ 1,116
Construction Management	$ 3,722	$ 320	$ 330	$ 339	$ 351	$ 364	$ 2,018
Construction	$ 16,213	$ 1,359	$ 1,420	$ 1,484	$ 1,536	$ 1,590	$ 8,824
Total	**$ 25,227**	**$ 2,134**	**$ 2,219**	**$ 2,306**	**$ 2,387**	**$ 2,472**	**$ 13,709**

Project FAMIS#:	CUH101PD
Project Title:	Hetch Hetchy Water - Power Infrastructure - Project Development - CUH101PD
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Jimmy Leong
Asset Classification:	Power Infrastructure
Type:	Capital
Description:	The Project Development (PD) Account captures Program level expenditures. There are four types of charges that will be allocated to the PD account: 1. Task Orders for overall program management and project prioritization tasks, where the costs should be distributed over all CIP Projects. 2. Infrastructure and Hetchy staff performing program level tasks including: capital plan development, budget management (including fund management, and cost reallocations); and Quarterly Report generation tasks, where the costs should be distributed over all CIP Projects 3. Portal support for the existing SharePoint Portal (includes document management and project dashboard reporting). 4. Work Outreach program.
Justification:	The Project Development Account (PD Account) funds the capital improvement administrative staff, the project management staff and the professional services that could not be defined to one project detail as the charges would span across the overall program.
Operating Impact:	Programmatic support is an integral part of the capital program.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 8,725	$ 750	$ 773	$ 796	$ 824	$ 852	$ 4,730
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 8,725**	**$ 750**	**$ 773**	**$ 796**	**$ 824**	**$ 852**	**$ 4,730**

Project FAMIS#:	CUH102 Comm
Project Title:	Hetch Hetchy Water - Communications (Joint) - CUH102 Comm
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Tim Parkan
Asset Classification:	Joint Infrastructure
Type:	Capital
Description:	This sub-program provides funds for an existing capital project to meet the Water Levels of Service for Regional Delivery Reliability and Sustainability, and HHWP's Operational Objectives for Power including Power System Reliability and Sustainability. The R&R Communications Systems Upgrades project will help to provide upgrades of the communication system elements to maintain pace with the changes in technology, and to maintain overall system reliability. The project will help to increase communications within the Moccasin compound.
Justification:	This sub-program is required to meet the Water Levels of Service for Regional Delivery Reliability and Sustainability, and HHWP's Operational Objectives for Power including Power System Reliability and Sustainability. In case of a disaster, the utilization of Moccasin Control and Server building would be a great asset to the City. Without the connectivity this solution is not possible. With the addition of fiber the overall connectivity of Moccasin would greatly increase. This sub-program provides the opportunity to increase the capacity of the city to respond to any disaster and allows an offsite communication hub.
Operating Impact:	HHWP needs additional bandwidth to use applications being deployed by the SFPUC and to implement one of the SFPUC disaster recovery systems. This project will alleviate bandwidth issues and provide for future growth.

All values in $1,000	**2019-2028**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024-2028**
Planning	$ 921	$ 30	$ 31	$ 32	$ 33	$ 34	$ 761
Environmental Review	$ 460	$ 15	$ 15	$ 16	$ 16	$ 17	$ 381
Design	$ 921	$ 30	$ 31	$ 32	$ 33	$ 34	$ 761
Construction Management	$ 921	$ 30	$ 31	$ 32	$ 33	$ 34	$ 761
Construction	$ 6,155	$ 195	$ 204	$ 213	$ 220	$ 228	$ 5,095
Total	**$ 9,378**	**$ 300**	**$ 312**	**$ 325**	**$ 335**	**$ 347**	**$ 7,759**

Project FAMIS#:	CUH102 Dam & Res
Project Title:	Hetch Hetchy Water - Dams & Reservoirs (Joint) - CUH102 Dam & Res
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Jimmy Leong
Asset Classification:	Joint Infrastructure
Type:	Capital
Description:	This sub-program provides funds for capital projects to enhance the Dams and Reservoirs under Joint funding to meet the Water Levels of Service and Power Operational Objectives. It covers O'Shaughnessy Dam and Lake Eleanor Dam. O'Shaughnessy Dam was first built in 1923 and then raised in 1938. The outlet/release systems of the dam have reached their design life and need major refurbishment or replacement. Due to the funding constraints, the O'Shaughnessy Dam Outlet work will be improved into two phases. The first phase, which is on-going, is to improve the access, bulkhead, gate valves and drum gates. The second phase will deal with large valves such as the 60" and 72" needle valves and their associated controls system. Eleanor Dam is a multiple arch reinforced concrete dam that was constructed in the 1920's. The dam has experienced various degree of degradation including cracking, spalling of concrete, exposed rebar, leakage through the arch barrels, and erosion of the spillway concrete. The project will address items categorized as long-term repairs that should be completed within the next 10 years. This sub-program also includes an R&R program to address the short term needs of different dams until the long term solution is implemented.
Justification:	This sub-program is required to meet the Water Levels of Service for Water Supply and Sustainability. Also, it is required to meet all HHWP's Operational Objectives for Power Including Power System Reliability, Regulatory Compliance and Sustainability.
Operating Impact:	A failure of dams or some of the components can result in lost water supply and inability to operate the facility safely under various hydrological conditions.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 11,599	$ 1,572	$ 77	$ 53	$ 55	$ 57	$ 9,785
Environmental Review	$ 12,483	$ 1,677	$ 185	$ 127	$ 132	$ 136	$ 10,226
Design	$ 23,632	$ 3,143	$ 155	$ 106	$ 110	$ 114	$ 20,004
Construction Management	$ 18,352	$ 225	$ 2,434	$ 159	$ 165	$ 170	$ 15,199
Construction	$ 114,599	$ 870	$ 14,761	$ 633	$ 656	$ 678	$ 97,001
Total	**$ 180,665**	**$ 7,487**	**$ 17,612**	**$ 1,078**	**$ 1,118**	**$ 1,155**	**$ 152,215**

Project FAMIS#:	CUH102 MT
Project Title:	Hetch Hetchy Water - Mountain Tunnel - CUH102 MT
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	David Tsztoo
Asset Classification:	Joint Infrastructure
Type:	Capital
Description:	Constructed between 1917-25, Mountain Tunnel (MT) is a critical, non-redundant link in the Hetch Hetchy water system, conveying SFPUC water supply from Kirkwood Powerhouse to Priest Reservoir. Due to tunnel's 90 years of operation, deferred maintenance, as well as the construction deficiencies in the early 1900s, sections of the tunnel have deteriorated, some more extensively than others. MT improvements to enhance SFPUC's ability to provide reliable, high-quality water to its customers, will be carried out through three projects: 1. MT Adits & Access Improvement and Emergency Restoration Plan 2. MT Inspection and Repair 3. MT Tunnel Bypass Mountain Tunnel Adits & Access Improvement Project will enlarge Adits 5/6 and 8/9 to accommodate quick entry of construction crews and equipment into the tunnel; and will improve access roads to the said adits. Project will also provide for the implementation of the Emergency Restoration Plan. Mountain Tunnel Inspection & Repairs Project provides for a tunnel inspection in 2017 to update the Condition Assessment conducted in 2008, as well as short-term repairs in 2017 and 2018 to reduce the risk of failures in the concrete lining prior to the long-term project being implemented. Mountain Tunnel Bypass Project will provide for evaluation of alternatives for the Mountain Tunnel facility, and eventually, the design and construction of the preferred engineering alternative that will keep this vital component of the Hetch Hetchy Water and Power System in reliable service for years to come. SFPUC has made a commitment to confirm the final long-term alternative (new 12-mile bypass tunnel or rehabilitation of existing tunnel) after an in-depth tunnel inspection and condition assessment has been conducted in 2017. Budget and schedule is based on the Bypass Tunnel alternative which has an anticipated construction phase between from 2020 to 2027 (MRN 238-241, 244, 245)
Justification:	A catastrophic failure, although possible, is unlikely without continued gradual degradation. The more likely type of anticipated failures are "local collapses", which would not impact power generation but would create water quality events in terms of turbidity in the water supply. The likelihood of localized collapses is moderate to high. Depending on the configuration of the system, this type of event could interrupt the delivery of the Tuolumne diversion to Water Supply and Treatment. Technology Policy: The project provides for reliable, high quality service, but is not specifically technology-related.
Operating Impact:	Depending on the configuration of the system, a "local collapse" could interrupt the delivery of the Tuolumne diversion to Water Supply and Treatment. Continual degradation of the asset could lead to a catastrophic failure.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 4,260	$ 2,840	$ 200	$ 1,220	$ 0	$ 0	$ 0
Design	$ 7,873	$ 5,249	$ 2,624	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 47,439	$ 8,723	$ 38,716	$ 0	$ 0	$ 0	$ 0
Construction	$ 151,534	$ 2,754	$ 0	$ 48,780	$ 50,000	$ 50,000	$ 0
Total	**$ 211,106**	**$ 19,566**	**$ 41,540**	**$ 50,000**	**$ 50,000**	**$ 50,000**	**$ 0**

Project FAMIS#:	CUH102 Road & Bridge
Project Title:	Hetch Hetchy Water - Roads & Bridges (Joint) - CUH102 Road & Bridge
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Jimmy Leong
Asset Classification:	Joint Infrastructure
Type:	Capital
Description:	This sub-program provides funds for capital projects to replace bridges as recommended in the condition assessment reports, as well as an R&R road improvement program for upkeep of access to numerous HHWP facilities. These projects include: 1. Bridge Replacement: a) Cherry Lake Road Bridge b) Early Intake Bridge c) O'Shaughnessy Adit d) Lake Eleanor Bridge 2. R&R Road Improvements
Justification:	The road and bridge network that HHWP maintains is vital for allowing access to numerous facilities throughout the system. These projects are required to meet the Water Levels of Service for Regional Seismic Reliability, Regional Delivery Reliability, Water Supply and Sustainability. These projects are also required to meet HHWP's Operational Objectives for Power including Power System Reliability and Sustainability.
Operating Impact:	These public roads and bridges must be maintained so staff can access critical assets and remote facilities. Work must be performed to meet current standards and operating needs.

All values in $1,000	**2019-2028**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024-2028**
Planning	$ 4,073	$ 736	$ 696	$ 487	$ 1,429	$ 102	$ 623
Environmental Review	$ 5,174	$ 826	$ 788	$ 583	$ 1,528	$ 205	$ 1,244
Design	$ 7,705	$ 1,436	$ 1,354	$ 937	$ 2,818	$ 164	$ 996
Construction Management	$ 5,914	$ 126	$ 1,081	$ 1,021	$ 715	$ 2,100	$ 871
Construction	$ 43,851	$ 1,260	$ 7,296	$ 7,034	$ 5,156	$ 14,136	$ 8,969
Total	**$ 66,717**	**$ 4,384**	**$ 11,215**	**$ 10,062**	**$ 11,646**	**$ 16,707**	**$ 12,703**

Project FAMIS#:	CUH102 Tunnels
Project Title:	Hetch Hetchy Water - Tunnels (Joint) - CUH102 Tunnels
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Jimmy Leong
Asset Classification:	Joint Infrastructure
Type:	Capital
Description:	This sub-program provides funds for tunnel related projects under Joint. Currently, the sub-program only consists of one project, namely the Canyon Tunnel-Hetchy Adit Rehabilitation. The Canyon Tunnel, built over 45 years ago, is approximately 10 miles long and delivers the SFPUC water supply from O'Shaughnessy Reservoir to Kirkwood Penstock. The tunnel is in good condition, but rehabilitation work at Hetchy Adit is required due to recent recorded leakage at this access point. Temporary repairs have been made, but further repairs are needed to reduce leakage and increase reliability of the system. The scope includes installation of a new reinforced concrete plug downstream of the existing plug. The new plug can be built while the Canyon Tunnel remains in service. Once the downstream plug is in?place and tested, a short duration outage will be needed to remove the existing sliding?steel bulkhead door to allow the full pressure to reach the new plug. The design is 95% complete. This project is being delayed because of boundary correction issues. (MRN 2)
Justification:	The Canyon Tunnel Rehabilitation project is required to meet the Water Levels of Service for Water Supply and Sustainability. The project is also required to meet HHWP's Operational Objectives for Power including Power System Reliability and Sustainability.
Operating Impact:	Failure at the Hetchy Adit will impact deliveries to SFPUC water customers. In the event of failure, customer deliveries will have to be met 100% from local bay area reservoirs or Tuolumne River emergency supply (Lower Cherry Aqueduct or directly from the Tuolumne River). There will also be an impact to generation while the facility is out of service.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 400	$ 0	$ 400	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 120	$ 0	$ 120	$ 0	$ 0	$ 0	$ 0
Design	$ 360	$ 0	$ 360	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 2,000	$ 0	$ 0	$ 2,000	$ 0	$ 0	$ 0
Construction	$ 5,000	$ 0	$ 0	$ 5,000	$ 0	$ 0	$ 0
Total	**$ 7,880**	**$ 0**	**$ 880**	**$ 7,000**	**$ 0**	**$ 0**	**$ 0**

Project FAMIS#:	CUH102 Utilities
Project Title:	Hetch Hetchy Water - Utilities (Joint) - CUH102 Utilities
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Brent Hörger
Asset Classification:	Joint Infrastructure
Type:	Capital
Description:	CUH102 Utilities sub-program includes the R&R Power Distribution Improvements candidate project. HHWP maintains several power distribution systems (<100 kV) to provide power to Moccasin Compound and remote operation sites (mainly Early Intake, Cherry and O'Shaughnessy). The systems are made up of transformers (to step down generation received from the powerhouses), poles, conductor and pole transformers for service connections. With the exception of about 40% of the poles and conductor up-country which was replaced as a result of the Rim Fire, the remaining system has exceeded its life expectancy, resulting in multiple failures in Moccasin last year. In addition, new loads to support operations at Moccasin and remote sites (e.g., UV systems) are taxing the current system, requiring mitigation. The Power Distribution R&R program will support funding of: 1. Load studies at Moccasin and remote locations 2. Replacement of the failing systems with systems designed to meet current load requirements. 3. Provide for spare large transformers (step down from generators) to ensure reliable 24/7 water and power operations for Moccasin Compound and remote sites.
Justification:	The R&R Power Distribution Improvements project will maintain the HHWP power distribution system in a state of good repair consistent with utility best practices to ensure staff have 24/7 power to run operations at Moccasin Compound and remote sites so staff can meet their obligations to provide existing Water Enterprise Levels of Service.
Operating Impact:	For the power distribution improvements, not all HHWP offices have emergency generators. Failure to maintain these assets affects staffs ability to perform their job, placing existing Water Enterprise Levels of Service at risk.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 508	$ 250	$ 258	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 508	$ 250	$ 258	$ 0	$ 0	$ 0	$ 0
Design	$ 1,015	$ 500	$ 515	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 4,489	$ 0	$ 0	$ 500	$ 515	$ 530	$ 2,944
Construction	$ 9,198	$ 0	$ 0	$ 1,000	$ 1,045	$ 1,092	$ 6,061
Total	**$ 15,718**	**$ 1,000**	**$ 1,031**	**$ 1,500**	**$ 1,560**	**$ 1,622**	**$ 9,005**

Project FAMIS#:	CUH102PD
Project Title:	Hetch Hetchy Water - Project Development - CUH102PD
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	Jimmy Leong
Asset Classification:	Joint Infrastructure
Type:	Capital
Description:	The Project Development (PD) Account captures Program level expenditures. There are four types of charges that will be allocated to the PD Account: 1. Task orders for overall program management and project prioritization tasks, where the costs should be distributed over all CIP Projects. 2. Infrastructure and Hetchy staff performing program level tasks including: capital plan development, budget management (including fund management, and cost reallocations); and Quarterly Report generation tasks, where the costs should be distributed over all CIP Projects. 3. Portal support for the existing SharePoint Portal (includes document management and project dashboard reporting). 4. Work Outreach program.
Justification:	The Project Development Account (PD Account) funds the capital improvement administrative staff, the project management staff and the professional services that could not be defined to one project detail as the charges would span across the overall program.
Operating Impact:	Programmatic support is an integral part of the capital program.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 23,266	$ 2,000	$ 2,060	$ 2,122	$ 2,196	$ 2,273	$ 12,615
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Total	**$ 23,266**	**$ 2,000**	**$ 2,060**	**$ 2,122**	**$ 2,196**	**$ 2,273**	**$ 12,615**

Project FAMIS#:	FUH10001
Project Title:	Hetch Hetchy Water - Facilities Maintenance - FUH10001
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	
Asset Classification:	Program - Project
Type:	Programmatic
Description:	Hetch Hetchy Water and Power is requesting an increase to HHWP's revenue-funded Facilities Maintenance budget.
Justification:	A comprehensive maintenance program ensures that Hetch Hetchy Water can continue to provide reliable water and power services. Maintenance funding is generally derived from operating capital, and new infrastructure projects are funded by capital funds, as adopted through the Water Enterprise Capital Improvement Program. With the advent of bond funding for the entire capital program, a separate revenue-funded programmatic project was created for Hetch Hetchy Water Facilities Maintenance in order to address corrective and unplanned maintenance. In Fiscal Year 17-18, the budget for Facilities Maintenance was $2.6 million. However, as infrastructure has aged, and Hetch Hetchy capital upgrades have been deferred, the need for unplanned/emergency maintenance funds has increased. In the past two years, Hetch Hetchy Water and Power has opened up their Incident Command System seven times to address emergency maintenance/failures: four times for natural disasters, and three times for major equipment failures, one of which was a Declared Emergency impacting water supply deliveries. Corrective maintenance including Unanticipated/emergency maintenance is expected to continue to increase.
Operating Impact:	Failure to budget for corrective and emergency maintenance has been impacting and delaying capital project completion. As infrastructure fails, capital projects are defunded and deferred to address the failed asset. This ultimately impacts service reliability of the system.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 29,105	$ 2,541	$ 2,617	$ 2,695	$ 2,775	$ 2,858	$ 15,619
Total	**$ 29,105**	**$ 2,541**	**$ 2,617**	**$ 2,695**	**$ 2,775**	**$ 2,858**	**$ 15,619**

Project FAMIS#:	PUH50401
Project Title:	Hetch Hetchy Water - HHW-WECC/NERC Compliance - PUH50401
Enterprise:	Hetch Hetchy Enterprise
Organization:	Hetch Hetchy Water
Project Manager:	
Asset Classification:	Program - Project
Type:	Programmatic
Description:	The reliability of the Nation's power grid, the Bulk Electric System (BES), is regulated by the Federal Energy Regulatory Commission (FERC) through agreement with the North American Electric Reliability Corporation (NERC). Hetch Hetchy Water and Power (HHWP) is a NERC registered Generator Owner, Generator Operator, Transmission Owner, Transmission Operator and Transmission Planner, and as such is subject to mandatory and enforceable NERC Reliability Standards. In the western US, NERC delegates primary responsibility for monitoring and enforcement of NERC Reliability Standards to the Western Electricity Coordinating Council (WECC). The SFPUC Electric Power Reliability Compliance Program (NERC Compliance Program) establishes internal processes and provides funding to assure HHWP compliance with almost 1,000 NERC Standards requirements that apply to HHWP. The Compliance Program designates the Division Manager of HHWP as the NERC Compliance Officer, charged with administration of the NERC Compliance Program with the support of Executive Staff and a NERC Compliance Team, comprised of the NERC Compliance Officer, a Compliance Manager who reports to the NERC Compliance Officer, a designee from the SFPUC Power Enterprise, a designee from SFPUC Business Services and a deputy City Attorney. Day-to-day compliance with NERC Standards relies upon the extensive participation of HHWP power operations staff, engineering staff, IT staff, vegetation management staff, and HR staff under the leadership of the HHWP NERC Compliance Manager.
Justification:	The need to comply with NERC Reliability Standards is recognized by the SFPUC as a permanent part of doing business in the electric power industry. The NERC Compliance Program documents the SFPUC's responsibility and commitment to meet its NERC regulatory obligation. In addition to on-going compliance with existing NERC Standards, HHWP is required to stay on top of new and revised standards. As a result HHWP compliance processes must expand or evolve to address a growing number of NERC Standards, and their increased complexity. The Critical Infrastructure Protection (CIP) Standards are a well-publicized example of over 120 new NERC requirements which establish requirements for physical and cyber security protection of critical assets became effective for HHWP in 2016. Currently HHWP has one permanent position available for the day-to-day implementation and oversight of its NERC compliance obligations. HHWP has identified in this proposal staffing deficiencies which impact its ability to execute the mandate of the SFPUC Electric Power Reliability Compliance Program and recommended staff additions for the NERC Compliance Program. The proposal also addresses upgrades to critical systems, processes and training that are needed to ensure compliance with NERC Reliability Standards.
Operating Impact:	Violations either discovered by WECC or self-reported by HHWP may have significant financial and reputational implications. Along with monetary penalties ranging from $1,000 to $1,250,000 per day, violations of Reliability Standards impact the SFPUC by involving: expenditures on legal defense, development of costly mitigation plans, SFPUC and City Attorney staff time, and impacts on CCSF's reputation within the industry and with the public.

All values in $1,000	2019-2028	2019	2020	2021	2022	2023	2024-2028
Planning	$ 31,450	$ 3,145	$ 3,145	$ 3,145	$ 3,145	$ 3,145	$ 15,725
Environmental Review	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Design	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Construction	$ 5,550	$ 555	$ 555	$ 555	$ 555	$ 555	$ 2,775
Total	**$ 37,000**	**$ 3,700**	**$ 3,700**	**$ 3,700**	**$ 3,700**	**$ 3,700**	**$ 18,500**